Knowledge graph: VOT

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OUTLINE OF THE LECTURE

PART I: KNOWLEDGE GRAPH

1. Introduction
2. Key characteristics
3. Ontologies and formal semantics
4. History of knowledge graph
5. Definitions
6. Implementations
7. Using knowledge graph for reasoning over data
8. Ontology
9. Semantic net work
10. Conceptual graphs

PART II: VISUAL ONTO THESAURUS (VOT)

1. Ontology principle
2. Nida's classification
3. Semantic Structure of vocabulary
4. Data base
5. VOTT user interface
6. Conclusion

PART I

KNOWLEDGE GRAPH

KNOWLEDGE GRAPH

- A knowledge graph is a knowledge base that uses a graph-structured data model or topology to integrate data.
- Knowledge graphs are often used to store interlinked descriptions of entities – objects, events, situations or abstract concepts – with free-form semantics.

KNOWLEDGE GRAPH

- The knowledge graph represents a collection of interlinked descriptions of entities – objects, events or concepts.
- Knowledge graphs put data in context via linking and semantic metadata and this way provide a framework for data integration, unification, analytics and sharing.

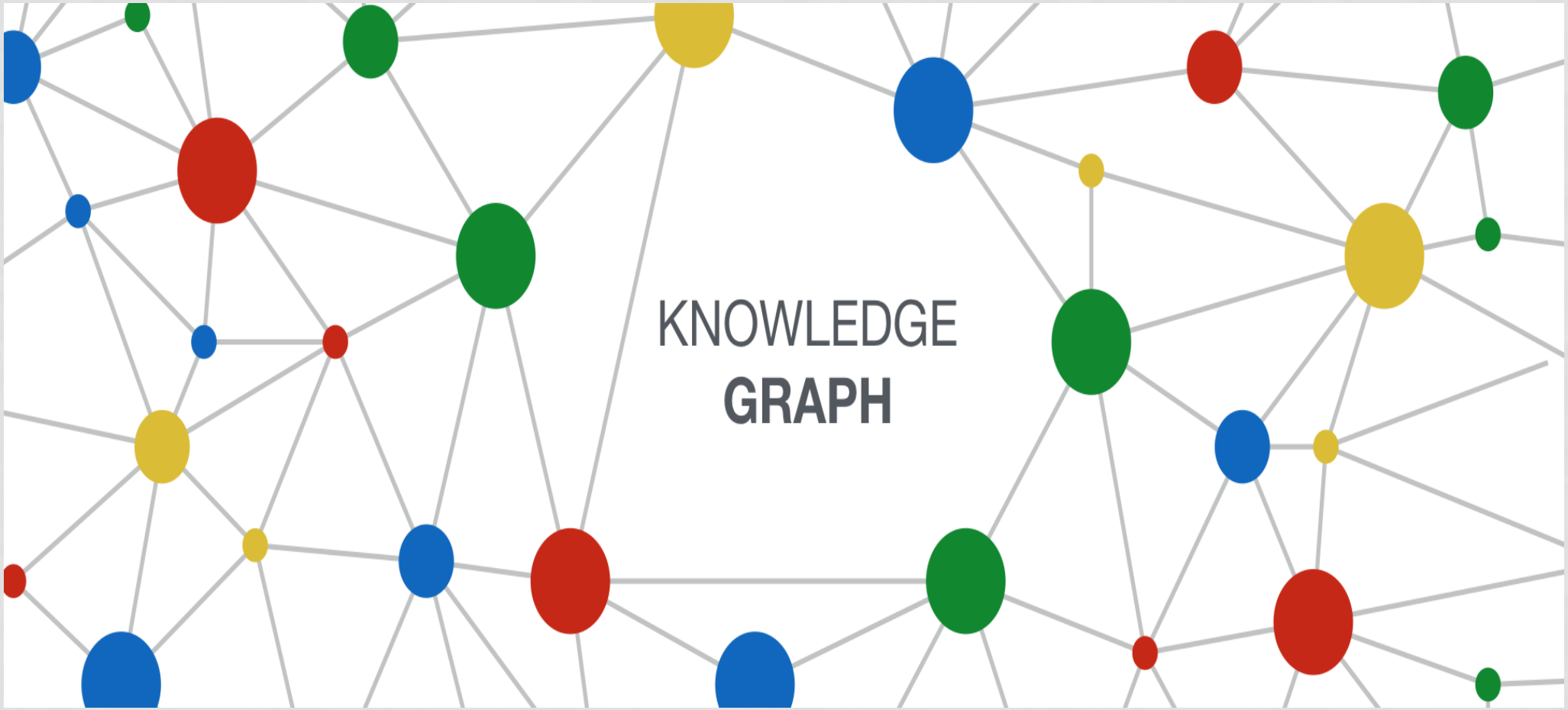
KNOWLEDGE GRAPH

- The knowledge graph (KG) represents a collection of interlinked descriptions of entities – real-world objects and events, or abstract concepts (e.g., documents) – where:
- Descriptions have formal semantics that allow both people and computers to process them in an efficient and unambiguous manner;
- Entity descriptions contribute to one another, forming a network, where each entity represents part of the description of the entities, related to it, and provides context for their interpretation.

KNOWLEDGE GRAPH

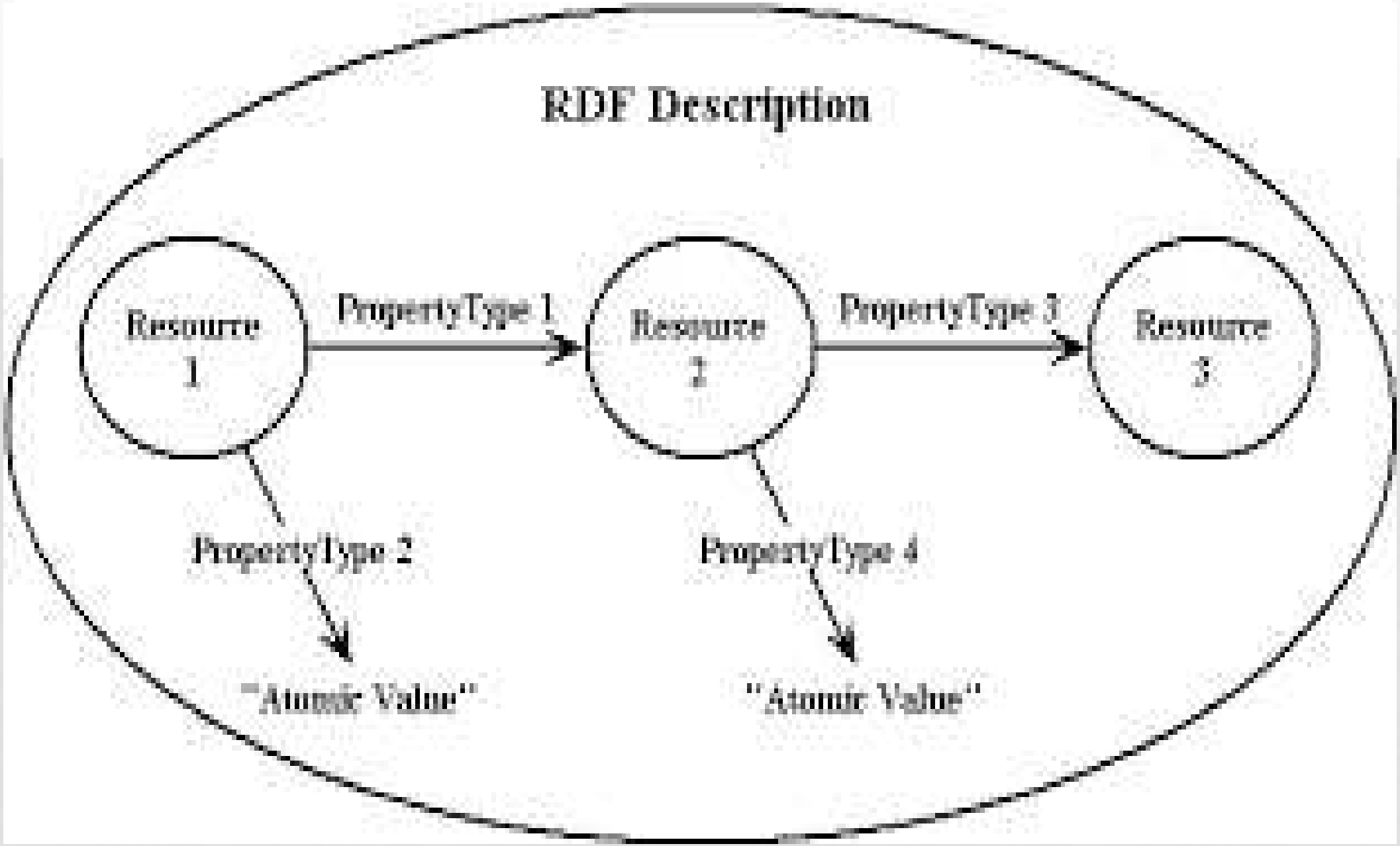
- Since the development of the Semantic Web, knowledge graphs are often associated with linked open data projects, focusing on the connections between concepts and entities.
- They are also prominently associated with and used by
  - search engines such as Google, Bing, and Yahoo;
  - knowledge-engines and question-answering services such as WolframAlpha, Apple's Siri, and Amazon Alexa; and
  - social networks such as LinkedIn and Facebook.

KNOWLEDGE GRAPH



KEY CHARACTERISTICS

- Knowledge graphs combine characteristics of several data management paradigms:
- Database, because the data can be explored via structured queries;
- Graph, because they can be analyzed as any other network data structure;
- Knowledge base, because they bear formal semantics, which can be used to interpret the data and infer new facts.


RDF Description
Resource 1
PropertyType 1
Resource 2
PropertyType 3
Resource 3
PropertyType 2
"Atomic Value"
PropertyType 4
"Atomic Value"

KNOWLEDGE GRAPH

- Knowledge graphs, represented in RDF (Resource Description Framwork), provide the best framework for data integration, unification, linking and reuse, because they combine:

KNOWLEDGE GRAPH

- **Expressivity: The standards in the Semantic Web stack – RDF(S) and OWL – allow for a fluent representation of various types of data and content: data schema, taxonomies and vocabularies, all sorts of metadata, reference and master data. The RDF* extension makes it easy to model provenance and other structured metadata.**

KNOWLEDGE GRAPH

- Performance: All the specifications have been thought out, and proven in practice, to allow for efficient management of graphs of billions of facts and properties.

KNOWLEDGE GRAPH

- **Interoperability: There is a range of specifications for data serialization, access (SPARQL Protocol for end-points), management (SPARQL Graph Store) and federation. The use of globally unique identifiers facilitates data integration and publishing.**

KNOWLEDGE GRAPH

- Standardization: All the above is standardized through the W3C community process, to make sure that the requirements of different actors are satisfied – all the way from logicians to enterprise data management professionals and system operations teams.

ONTOLOGIES AND FORMAL SEMANTICS

- Ontologies represent the backbone of the formal semantics of a knowledge graph.
- They can be seen as the data schema of the graph. They serve as a formal contract between the developers of the knowledge graph and its users regarding the meaning of the data in it.
- A user could be another human being or a software application that wants to interpret the data in a reliable and precise way.
- Ontologies ensure a shared understanding of the data and its meanings.

ONTOLOGIES AND FORMAL SEMANTICS

- When formal semantics are used to express and interpret the data of a knowledge graph, there are a number of representation and modeling instruments:

ONTOLOGIES AND FORMAL SEMANTICS

Classes:

- Most often an entity description contains a classification of the entity with respect to a class hierarchy.
- For instance, when dealing with business information there could be classes Person, Organization and Location.
- Persons and organizations can have a common superclass Agent.
- Location usually has numerous sub-classes, e.g., Country, Populated place, City, etc. The notion of class is borrowed by the object-oriented design, where each entity usually belongs to exactly one class.

ONTOLOGIES AND FORMAL SEMANTICS

Relationship types:

- **The relationships between entities are usually tagged with types, which provide information about the nature of the relationship, e.g., *friend*, *relative*, *competitor*, etc.**
- **Relationship types can also have formal definitions, e.g., that *parent-of* is inverse relation of *child-of*, they both are special cases of *relative-of*, which is a symmetric relationship. Or defining that *sub-region* and *subsidiary* are transitive relationships.**

ONTOLOGIES AND FORMAL SEMANTICS

Categories:

- **An entity can be associated with categories, which describe some aspect of its semantics, e.g., "Big four consultants" or "XIX century composers".**
- **A book can belong simultaneously to all these categories: "Books about Africa", "Bestseller", "Books by Italian authors", "Books for kids", etc.**
- **The categories are described and ordered into taxonomy.**

ONTOLOGIES AND FORMAL SEMANTICS

Free text descriptions:

Often a 'human-friendly text' description is provided to further clarify design intentions for the entity and improve search.

HISTORY

- The term was coined as early as 1972, in a discussion of how to build modular instructional systems for courses.
- In the late 1980s, Groningen and Twente universities jointly began a project called Knowledge Graphs, focusing on the design of semantic networks with edges restricted to a limited set of relations, to facilitate algebras on the graph.
- In subsequent decades, the distinction between semantic networks and knowledge graphs was blurred.

HISTORY

- Some early knowledge graphs were topic-specific.
- In 1985, Wordnet was founded, capturing semantic relationships between words and meanings – an application of this idea to language itself.
- In 2005, Marc Wirk founded Geonames to capture relationships between different geographic names and locales and associated entities.
- In 1998, Andrew Edmonds of Science in Finance Ltd in the UK created a system called ThinkBase that offered fuzzy-logic based reasoning in a graphical context.

HISTORY

- In 2007, both DBpedia and Freebase were founded as graph-based knowledge repositories for general-purpose knowledge.
- DBpedia focused exclusively on data extracted from Wikipedia, while Freebase also included a range of public datasets.
- Neither described themselves as a 'knowledge graph' but developed and described related concepts.

HISTORY

- In 2012, Google introduced their Knowledge Graph, building on DBpedia and Freebase among other sources.
- They later incorporated RDFa, Microdata, JSON-LD content extracted from indexed web pages, including the CIA World Factbook, Wikidata, and Wikipedia.

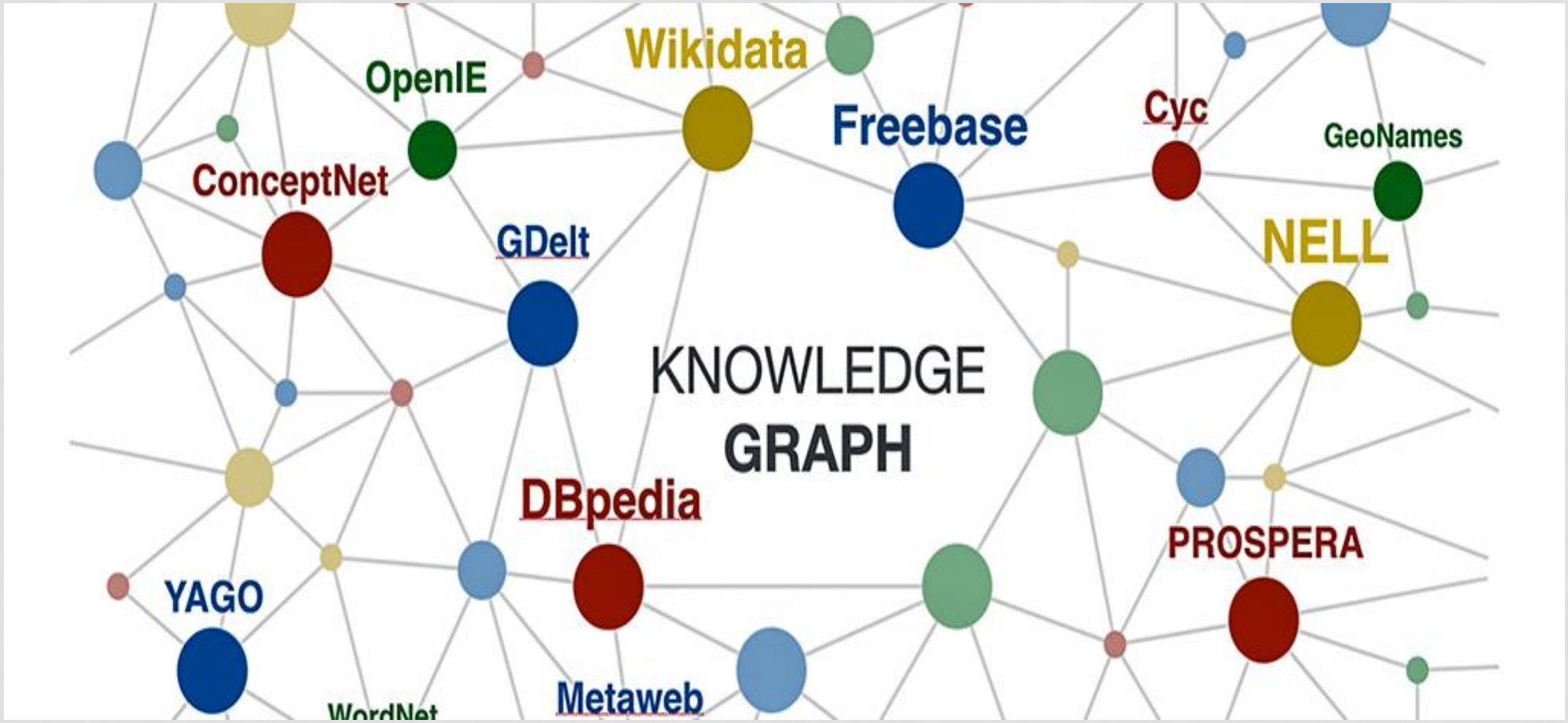
HISTORY

- Entity and relationship types associated with this knowledge graph have been further organized using terms from the schema.org vocabulary.
- The Google Knowledge Graph became a successful complement to string-based search within Google, and its popularity online brought the term into more common use.

HISTORY

- Since then, several large multinationals have advertised their knowledge graphs use, further popularising the term.
- These include Facebook, LinkedIn, Airbnb, Microsoft, Amazon, Uber and eBay.

HISTORY


Wikidata
OpenIE
Freebase
Cyc
GeoNames
ConceptNet
GDelt
NELL
KNOWLEDGE
GRAPH
DBpedia
PROSPERA
YAGO
Metaweb

DEFINITIONS

- There is no single commonly accepted definition of a knowledge graph.
- Most definitions view the topic through a Semantic Web lens and include these features:
- Flexible relations among knowledge in topical domains: A knowledge graph

  (i) defines abstract classes and relations of entities in a schema,

  (ii) mainly describes real world entities and their interrelations, organized in a graph,

  (iii) allows for potentially interrelating arbitrary entities with each other, and

  (iv) covers various topical domains.

DEFINITIONS

- General structure: A network of entities, their semantic types, properties, and relationships.
- Supporting reasoning over inferred ontologies: A knowledge graph acquires and integrates information into an ontology and applies a reasoner to derive new knowledge.

DEFINITIONS

- There are, however, many knowledge graph representations for which some of these features are not relevant. For those knowledge graphs this simpler definition may be more useful:
- A digital structure that represents knowledge as concepts and the relationships between them (facts).
- A knowledge graph can include an ontology that allows both humans and machines to understand and reason about its contents.

IMPLEMENTATIONS

- In addition to the above examples, the term has been used to describe open knowledge projects such as YAGO and Wikidata; federations like the Linked Open Data cloud; a range of commercial search tools, including Yahoo's semantic search assistant Spark, Google's Knowledge Graph, and Microsoft's Satori; and the LinkedIn and Facebook entity graphs.
- The term is also increasingly used by note taking applications allowing a user to build their personal knowledge graph.

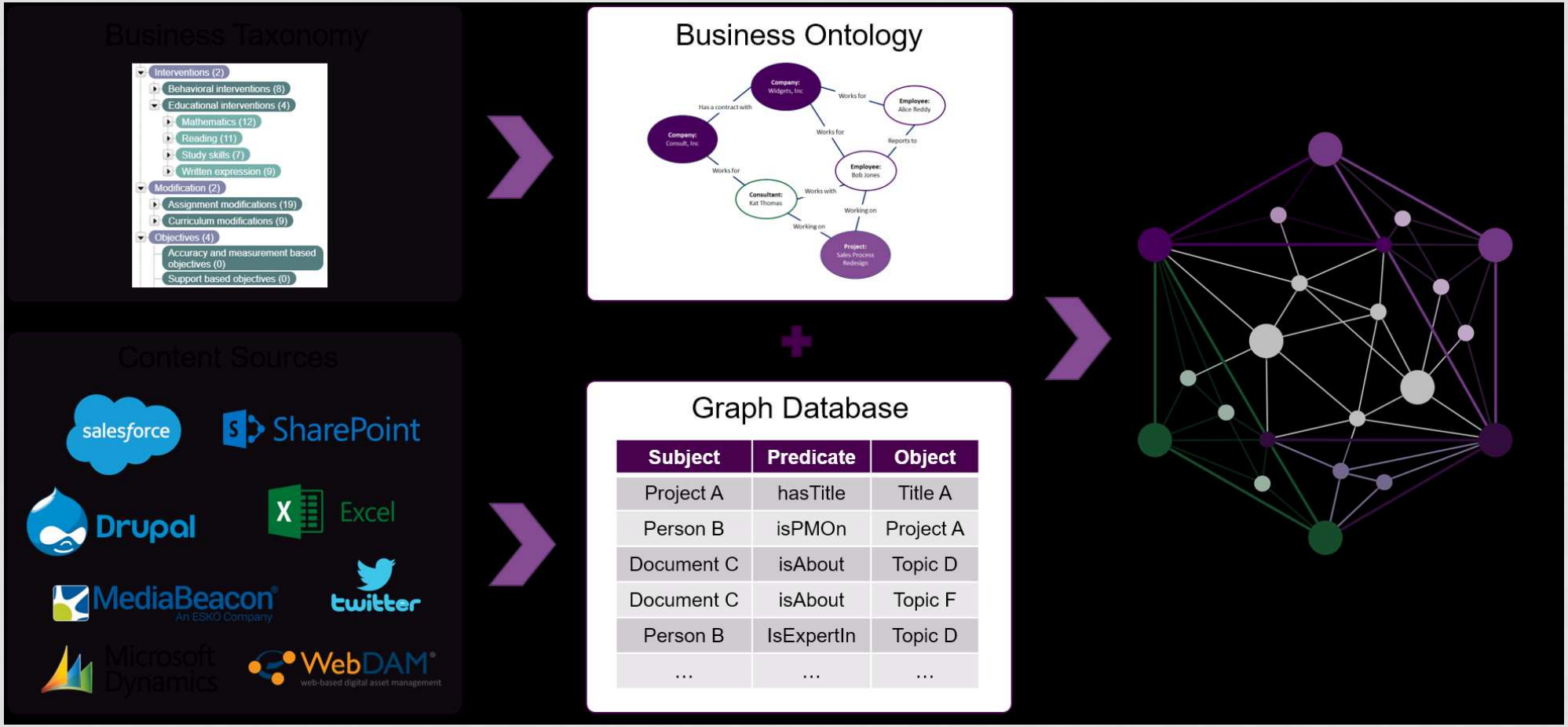
USING A KNOWLEDGE GRAPH FOR REASONING OVER DATA

- A knowledge graph formally represents semantics by describing entities and their relationships.
- Knowledge graphs may make use of ontologies as a schema layer.
- By doing this, they allow logical inference for retrieving implicit knowledge rather than only allowing queries requesting explicit knowledge.

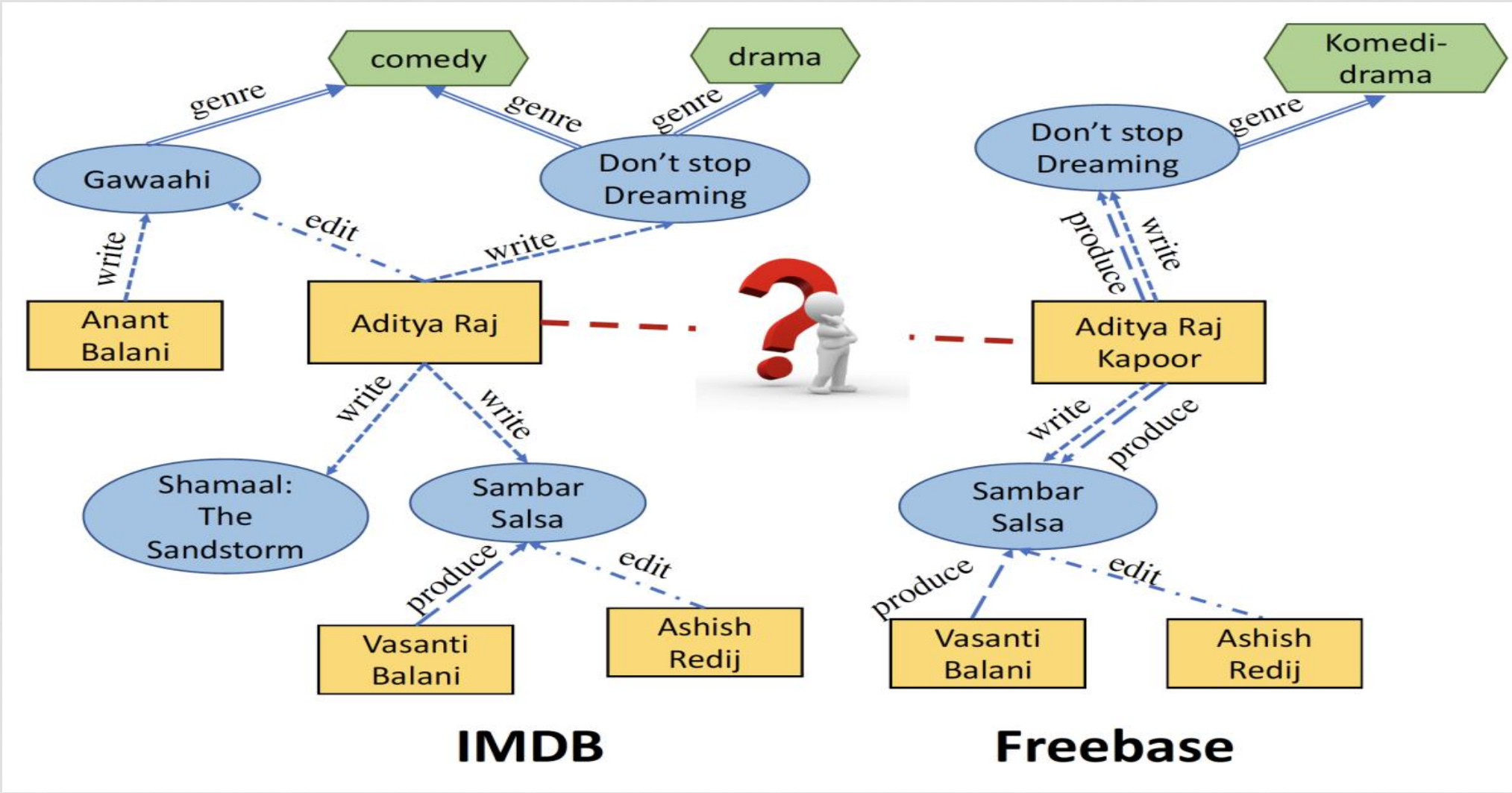
USING A KNOWLEDGE GRAPH FOR REASONING OVER DATA

- In order to allow the use of knowledge graphs in various machine learning tasks, several methods for deriving latent feature representations of entities and relations have been devised.
- These knowledge graph embeddings allow them to be connected to machine learning methods that require feature vectors like word embeddings.
- This can complement other estimates of conceptual similarity.

KEY COMPONENTS OF AN ENTERPRISE KNOWLEDGE GRAPH



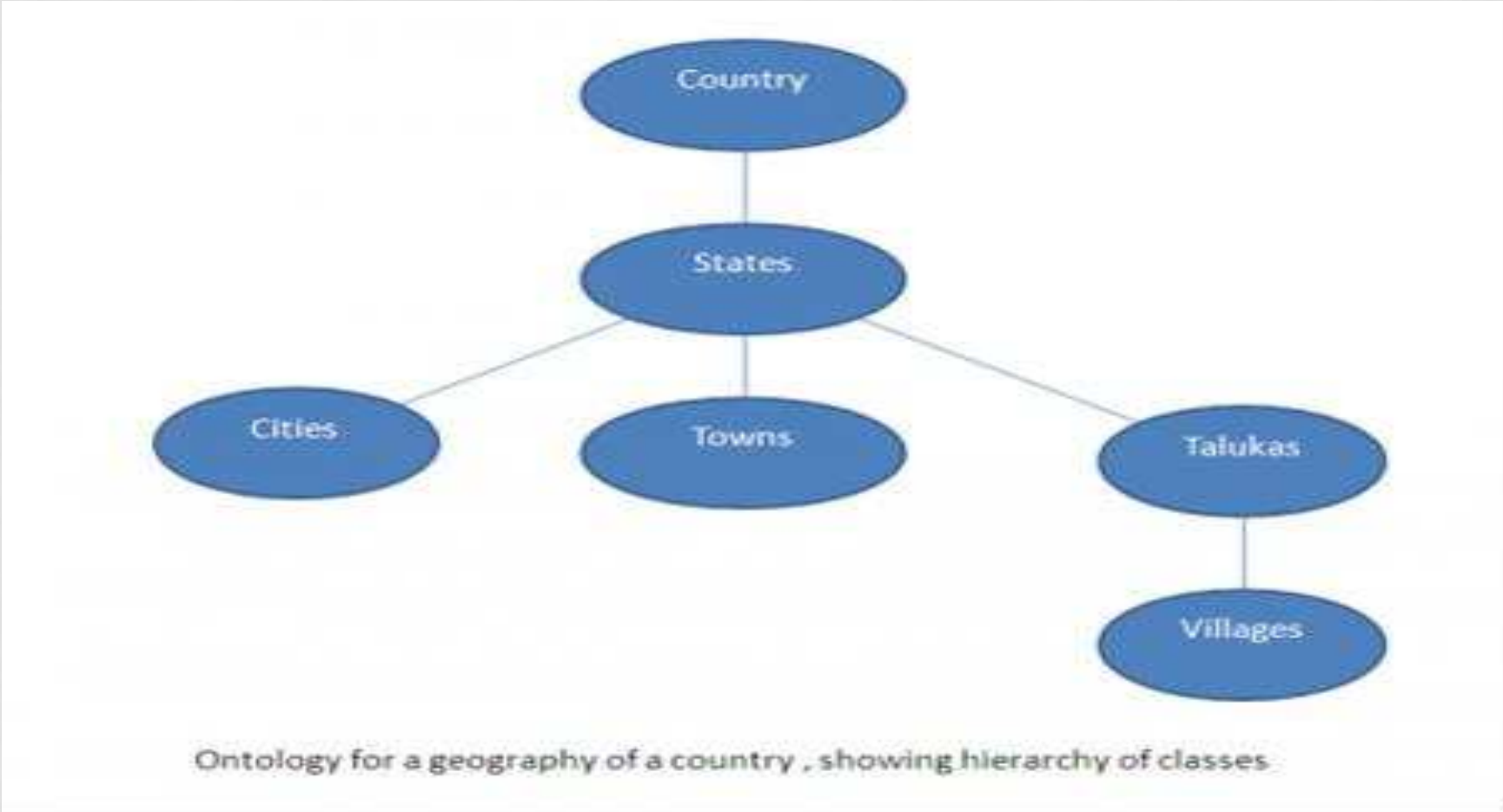
COMBINING KNOWLEDGE GRAPHS, QUICKLY AND ACCURATELY



ONTOLOGY

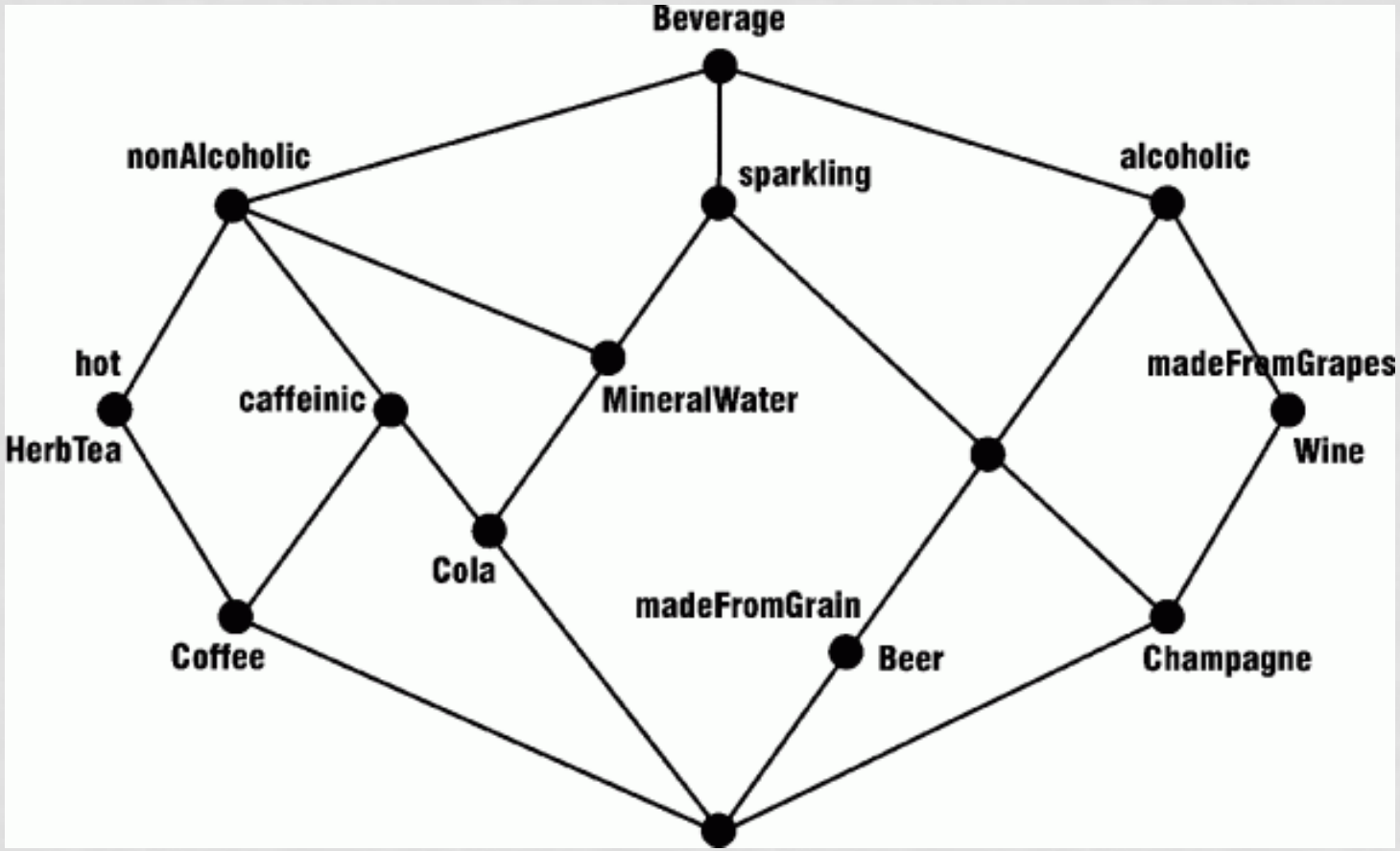
- In computer science and information science, an ontology encompasses a representation, formal naming and definition of the categories, properties and relations between the concepts, data and entities that substantiate one, many or all domains of discourse.
- More simply, an ontology is a way of showing the properties of a subject area and how they are related, by defining a set of concepts and categories that represent the subject.

ONTOLOGY



Ontology for a geography of a country , showing hierarchy of classes

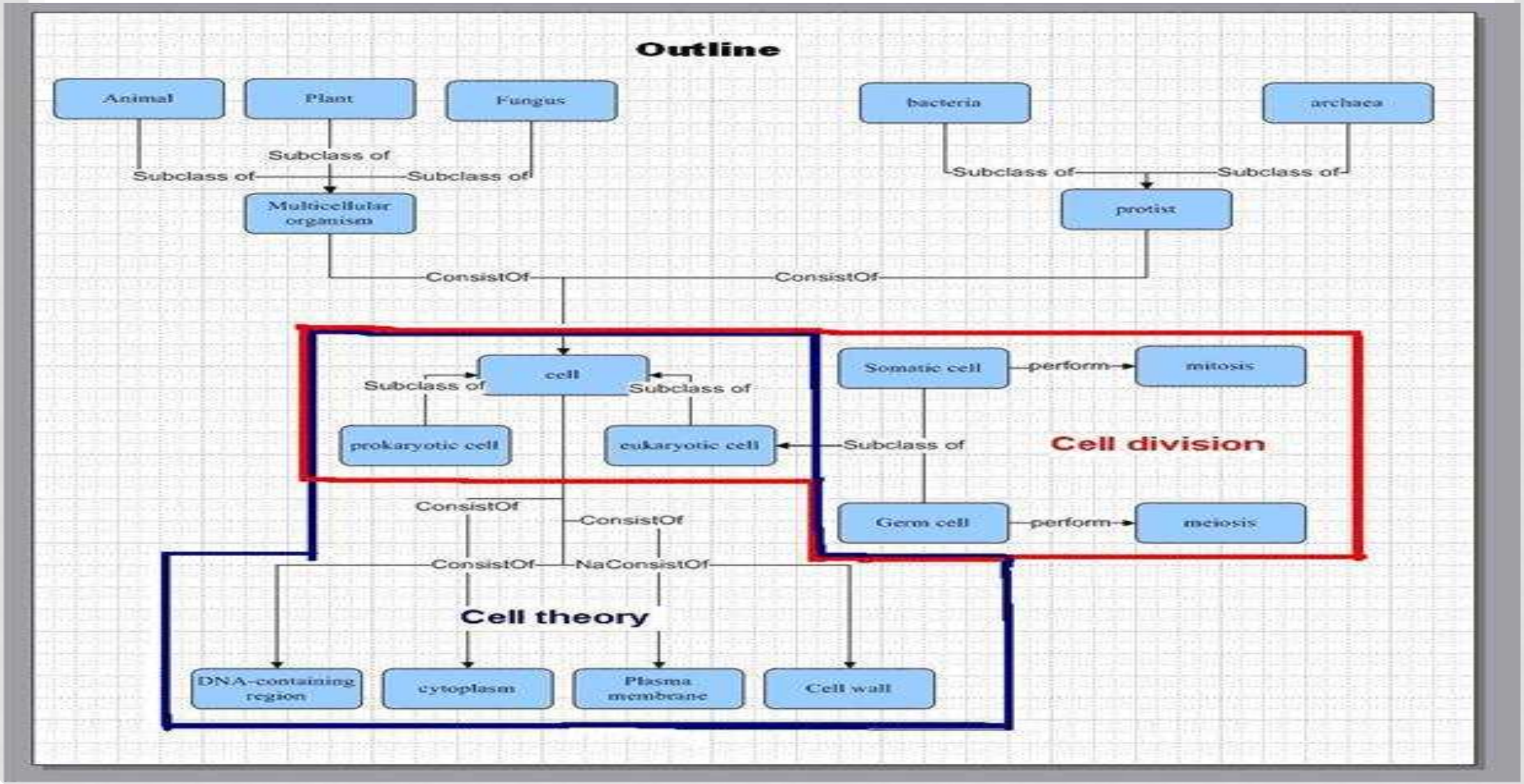
BEVRAGE ONTOLOGY



CELL ONTOLOGY

- The following is the knowledge based ontology for cell (found in internet). The cell concepts are related by the relations such as ‘consists of’, ‘type of’, ‘sub-type of’ and ‘perform.

CELL ONTOLOGY



ONTOLOGY

- Every academic discipline or field creates ontologies to limit complexity and organize data into information and knowledge.
- New ontologies improve problem solving within that domain.
- Translating research papers within every field is a problem made easier when experts from different countries maintain a controlled vocabulary of jargon between each of their languages.

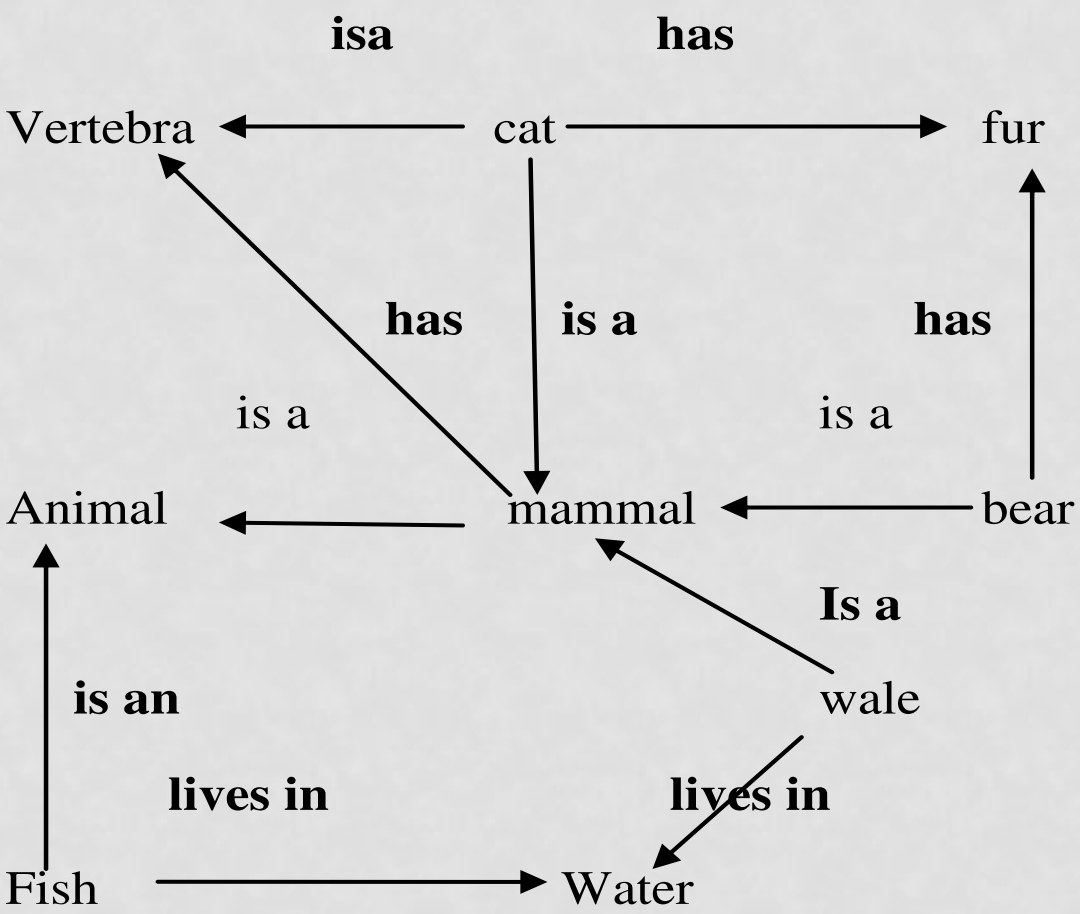
SEMANTIC NETWORK

- A semantic network, or frame network is a knowledge base that represents semantic relations between concepts in a network. This is often used as a form of knowledge representation.
- It is a directed or undirected graph consisting of vertices, which represent concepts, and edges, which represent semantic relations between concepts, mapping or connecting semantic fields.
- A semantic network may be instantiated as, for example, a graph database or a concept map.

SEMANTIC NETWORK

- Typical standardized semantic networks are expressed as semantic triples.
- Semantic networks are used in natural language processing applications such as semantic parsing and word-sense disambiguation.

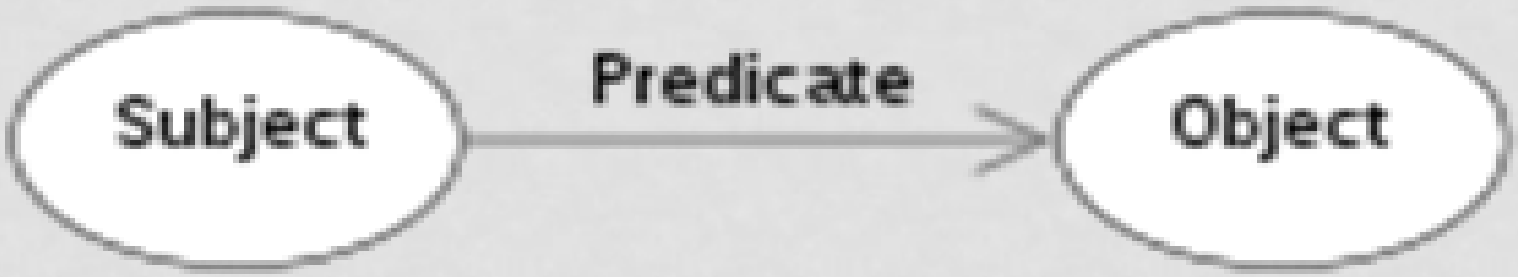
SEMANTIC NETWORK



SEMANTIC NETWORK

- A semantic triple, or RDF triple or simply triple, is the atomic data entity in the Resource Description Framework (RDF) data model.
- As its name indicates, a triple is a set of three entities that codifies a statement about semantic data in the form of subject–predicate–object expressions (e.g., "Bob is 35", or "Bob knows John").

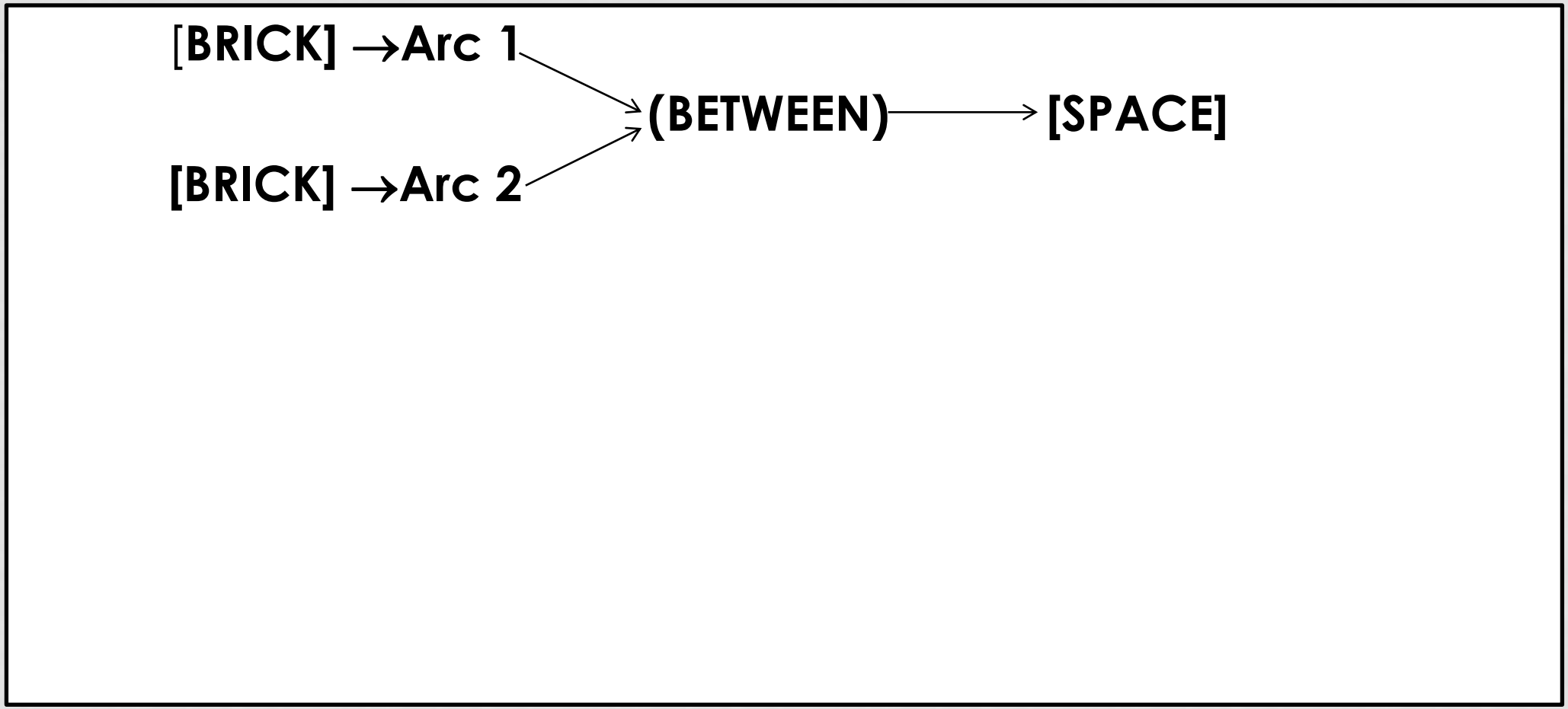
SEMANTIC NETWORK



CONCEPTUAL GRAPHS

- Concepts are language independent ones derived from percepts.
- A conceptual graph is a finite, connected, bipartite graph.
- The two kinds of nodes of the bipartite graph are concepts and conceptual relations.
- Every conceptual relation has one or more arcs, each of which must be linked to some concept.
- For example, a space between a brick and a brick can be represented as follows:

CONCEPTUAL GRAPHS



CONCEPTUAL GRAPHS

- Conceptual graphs form a knowledge representation of language based on linguistics, psychology, and philosophy.
- In the graphs, concept nodes represent entities, attributes, states, and events, and relation nodes show how the concepts are interconnected.
- Distinctions can be made between simple and complex concepts.
- Simple concepts are basic concepts from which complex concepts can be derived.
- Conceptual graphs form a knowledge representation of language based on linguistics, psychology, and philosophy.

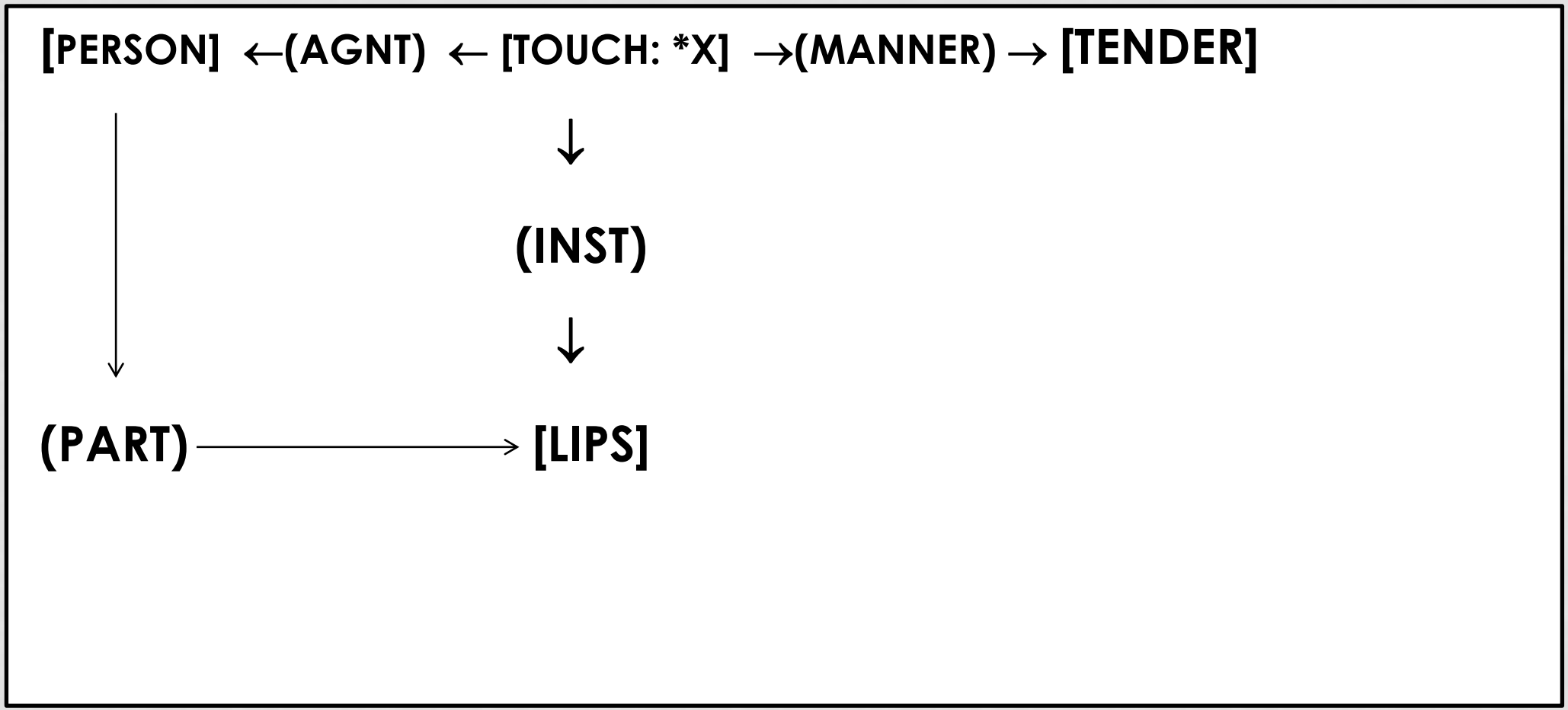
SEMANTIC NET WORK

- **The concept types CAT and TOMATO map directly to percepts.**
- **Other types like PRICE, FUNCTION and JUSTICE have no sensory correlates.**
- **Abstract concepts acquire their meanings not through direct associations with percepts, but through vast networks of relationship that ultimately links them to concrete concepts.**
- **A conceptual graph has no meaning in isolation.**
- **The description of the concept, MAN is represented as follows:**
- [MAN] → (ISA) → [HUMAN BEING] → (ISA) → [ANIMAL]

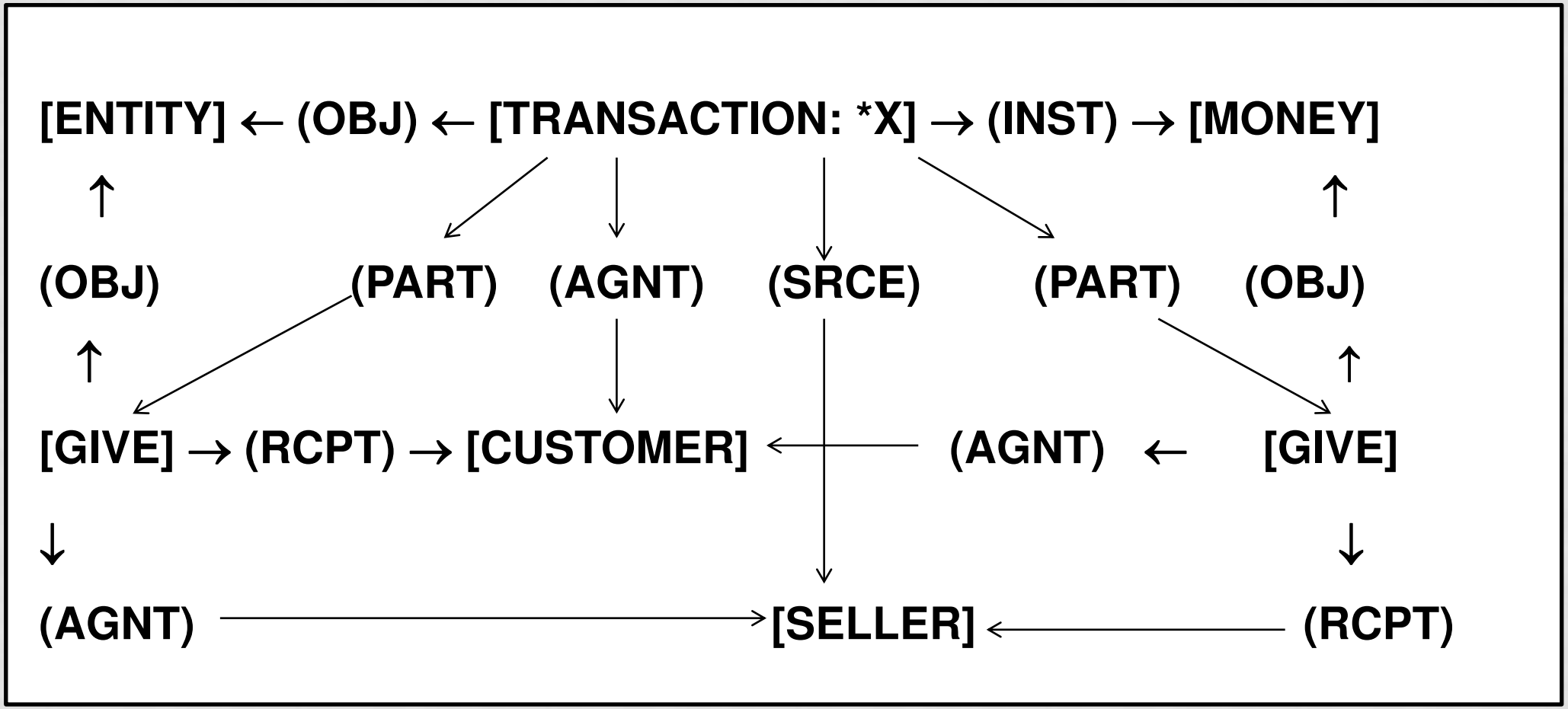
ABSTRACTION AND DEFINITION

- Definition can specify a type in two different ways: by stating necessary and sufficient conditions for the type, or by giving a few examples and saying that everything similar to these belongs to the type.
- Conceptual graphs support type definitions by genus and differentiae as well as schemata and prototypes.

TYPE DEFINITION FOR KISS



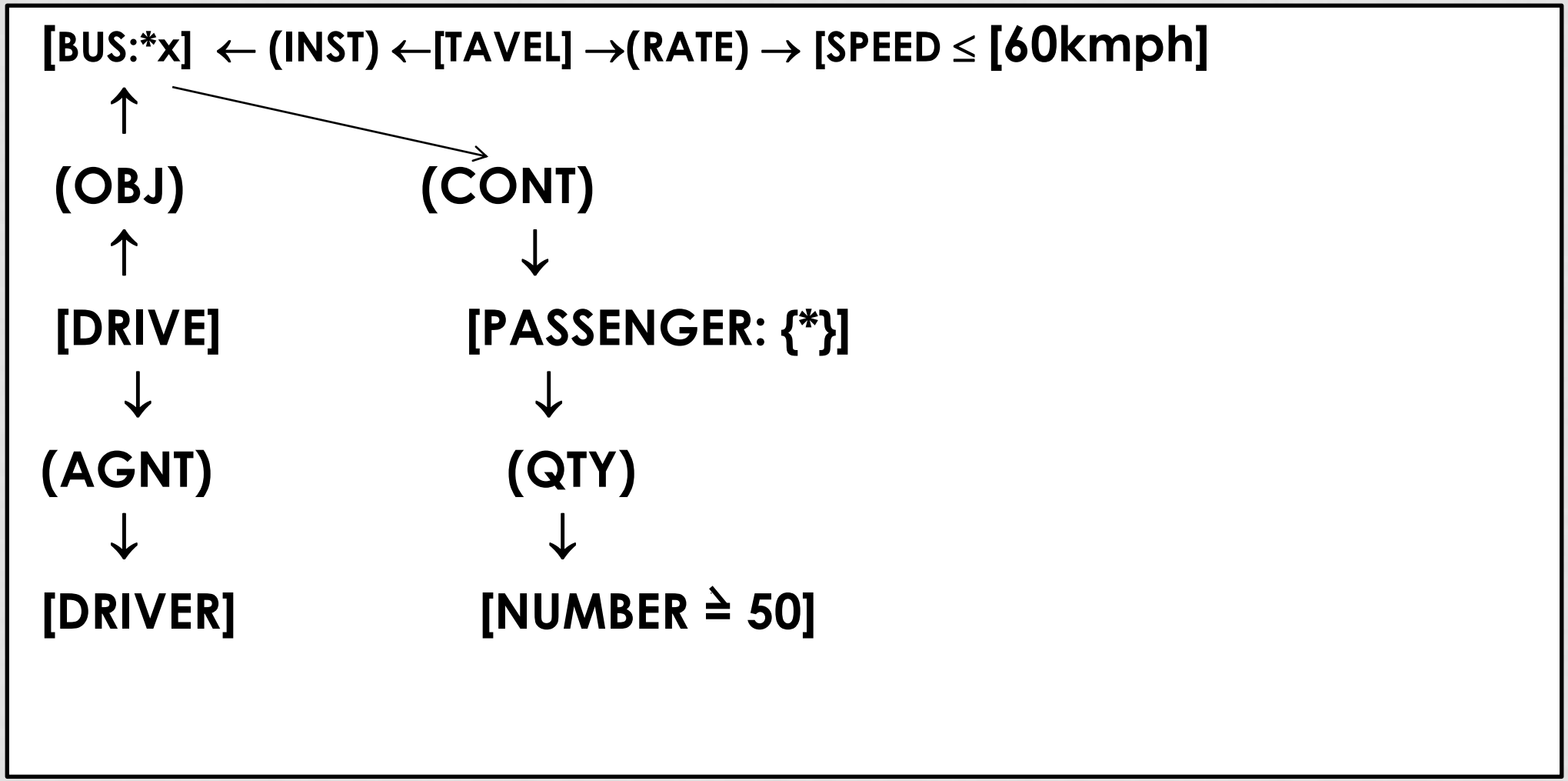
TYPE DEFINITION OF BUY (X) IS



SCHEMATA

- Schemata are similar in structure to type definition.
- Yet concept type may have at most one definition, but arbitrarily many schemata.
- Type definitions present the narrow notion of a concept, and schemata present the broad notion.
- Type definitions are obligatory conditions that state only the essential properties, but schemata are optional defaults that state the commonly associated accidental properties.
- Schemata show the typical ways in which a concept may be used, but they do not describe a typical instance of a concept.

SCHEMA FOR BUS (X) IS



PROTOTYPE

- A prototype is a typical instance.
- Instead of describing a specific individual, it describes a typical of "average individual".
- A Schema for ELEPHANT might specify a range of characteristics for elephants or a range of behaviours and habitats for elephants.
- A prototype ELEPHANT would combine and restrict such schema to describe a typical elephant

PROTOTYPE

Proto type for ELEPHANT (x) is

[ELEPHANT:*x] –

(CHAC) → [HEIGHT: @ 3.3 m]

(CHAC) → [WEIGHT: @ 5400 kg]

(COLR) → [DARK-GREY]

(PART) → [NOSE]-

(ATTR) → [PREHENSILE]

(IDNT) → [TRUNK]

(PART) → [EAR] {*}] –

(QTY) → [NUMBER:2]

(ATTR) → [FLOPPY]

(PART) → [TUSK: {*}] –

(QTY) → [NUMBER:2]

(MATR) → [IVORY]

(PART) → [LEG: {*}]

(QTY) → [NUMBER:4]

(STAT) → [LIVE] –

(LOC) → [CONTINENT: {Africa | Asia}]

(DUR) → [TIME: @ 50 YEARS]

CONCEPTUAL REPRESENTATION

- Some of the conceptual relations listed in Sowa (1984) are adopted to suit our purpose.

agent. (AGNT) links [ACT] to [ANIMATE], where ANIMATE concept represents the actor of the action.

attribute. (ATTR) links [ENTITY:*x] to [ENTITY:*y] where *x has an attribute *y.

cause. (CASE) links [STATE:*x] to [STATE:*y] where *x has a cause *y.

characteristic. (CHRC) links [ENTITY:*x] to [ENTITY:*y] where *x has a characteristic *y.

destination. (DEST) links [ACT] to [ENTITY] towards which the action is directed.

experience (EXPR) links [STATE] to [ANIMATE], who is experiencing that state.

instrument. (INST) links [ENITY] to [ACT] in which the entity is causally involved.

source. (SRCE) links an [ACT] to an [ENTITY] from which it originates.

LEXICAL RELATIONS

- **WordNet is an online lexical resource which is built over an ontology in which the building blocks are synsets (i.e. synonymy sets) and the sensets are connected to each other by a network of relations, both semantic and lexical relations.**
- **The important ones of these relations are: Hyponymy-Hypernymy, Meronymy-Holonymy, Troponymy and Entailment.**
- **These relations can also be made use of when we prepare a conceptual dictionary for cross-language representation. The following examples depict the above mentioned relations**

LEXICAL RELATIONS

[ANIMAL] → (HYPER)→ [MAMMAL]

[COW] → (HYPO) → [MAMMAL]

[TABLE] → (HOLO) → [LEG]

[PROFESSOR] →(MEMB) → [DEPARTMENT]

[WHEEL] → (MERO) →[CART]

[WALK] → (TROPO)→ [LIMP]

[SNORE] →(ENTA)→ [SLEEP]

SAMPLE OF CONCEPTUAL LEXICON

- **The following is the sample of the conceptual lexicon. Each item is a concept and the concepts will be mapped against the lexical items in a language.**

[CAT] → (ISA) → [ANIMAL]

[PENCIL] → (ISA) → [INSTRUMENT]

↓

(FUNCT)

↓

[WRITING]

SAMPLE OF CONCEPTUAL LEXICON

- The verbs will be provided with their argument structures. A frame of arguments will be given with their necessary relations. The verbal concept ACT will be represented in the following fashion.

[ACT] → (ISA) → [EVENT]-

(AGENT) → [ANIMATE ENTITY]

[ARRIVE] → (ISA) → [EVENT] -

(AGENT) → [MOBILE-ENTITY]

(GOAL) → [LOCATION]

LEXICAL AND CONCEPTUAL STRUCTURES

- Each natural language has a well-organized lexical and syntactic system. Each domain of knowledge has a well-organized conceptual system.
- Complexities arise because each language tends to use and reuse the same words and lexical patterns in many different conceptual domains.

LEXICAL AND CONCEPTUAL STRUCTURES

The lexical structures are

- Relatively domain independent
- Dependent on syntax and word forms
- Highly language dependent

LEXICAL AND CONCEPTUAL STRUCTURES

The conceptual structures are

- Highly domain dependent
- Independent of syntax and word forms
- Language independent, but possibly culture dependent

LEXICAL AND CONCEPTUAL STRUCTURES

- **When there are cross-linguistic similarities in lexical patterns, they usually result from underlying conceptual similarities.**
- **English verb *give*, for example, takes a subject, object, and indirect object.**
- **Other languages may have different cases marked by different prepositions, postpositions, inflections, and word order; but the verb that mean roughly the same as *give* also have three participants – a giver, a thing given, and a recipient.**
- **In all languages, the three participants in the conceptual pattern lead to three arguments in the lexical patterns.**

LEXICAL AND CONCEPTUAL STRUCTURES

The distinction between lexical structures and conceptual structures addresses the following things:

- **Lexical structures are oriented towards language. The representation developed here is strongly influenced by linguistic theories of syntax and thematic roles.**
- **Conceptual structures are designed for representing knowledge about the world.**
- **They may grow too large to be expressed in a single sentence, and they may contain concepts types that cannot be expressed by a single word.**

LEXICAL AND CONCEPTUAL STRUCTURES

- Since they can be represented by similar structures, the same operations can be used on them.
- Furthermore, lexical structures can be converted to deeper conceptual structures by a step-by-step process, not by a translation between radically different forms.
- Finally, common structures facilitate language learning and conceptual creativity.
- In learning, a child generalizes conceptual structures learned from experience to form the initial lexical structures needed for language.
- Metaphor and conceptual refinement create new conceptual structures by adapting old lexical structures to novel situations.

LEXICAL AND CONCEPTUAL STRUCTURES

- The distinction between lexical structures and conceptual structures provides a principled basis for partitioning knowledge into the lexicon and the more detailed knowledge about the world.
- Conceptual graphs provide formalism for representing both kinds of structures with a level of precision that allows deeper and more systematic analysis of the relationship between them.

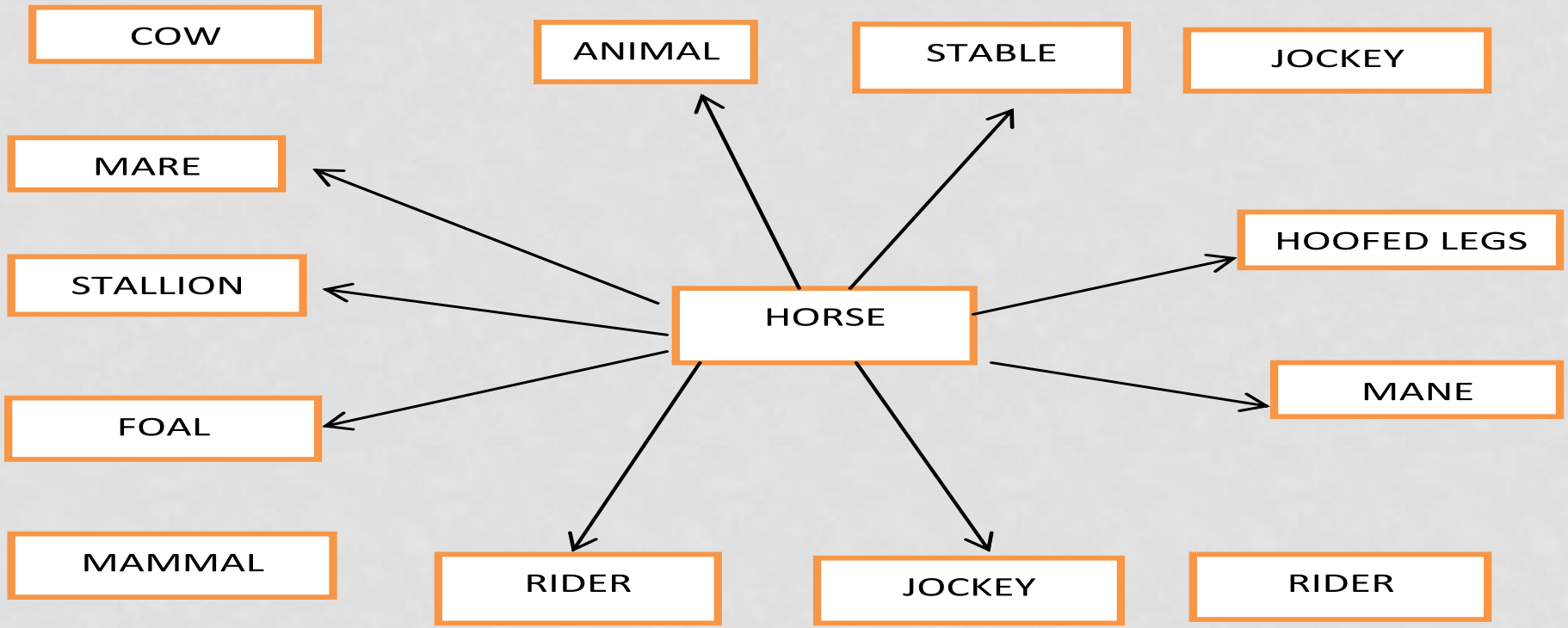
LEXICAL AND CONCEPTUAL STRUCTURES

- As a result, they can help to replace vague discussion with a precise methodology that has a greater chance of being computerized.
- Finally the direct mapping between conceptual graph and natural language can simplify the task of knowledge acquisition: a knowledge base of conceptual graphs could be generated directly from natural language inputs.
- After being primed with a dictionary of lexical knowledge, the system could build up its own encyclopaedia of world with the aid of a tutor communicating in English, not a knowledge engineer coding in a specialized notation.

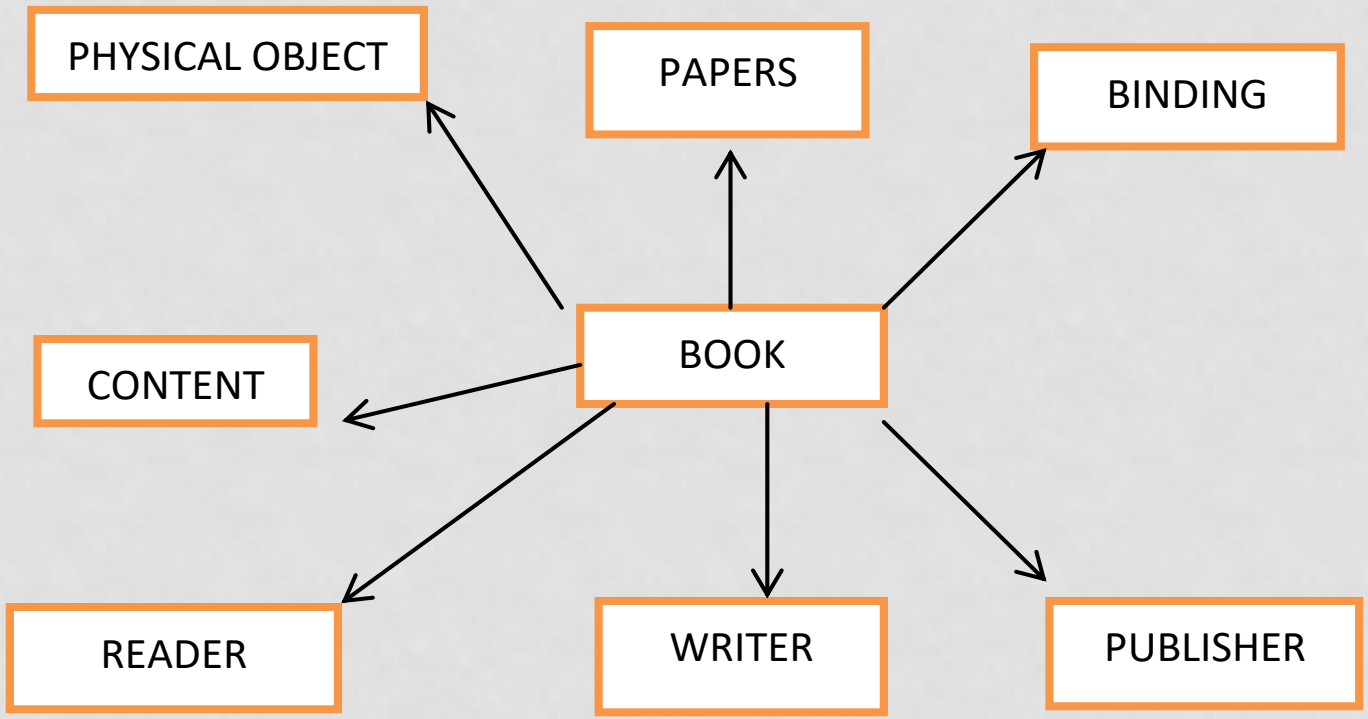
EXPANDING THE LEXICAL KNOWLEDGE

- The representations we have shown earlier are simple. But we may need more knowledge about lexical items if we are truly making use of them for communication and proper understanding.
- Take for example, the lexical items *horse* and *book*. They may need at least the following representations.

EXPANDING THE LEXICAL KNOWLEDGE



EXPANDING THE LEXICAL KNOWLEDGE

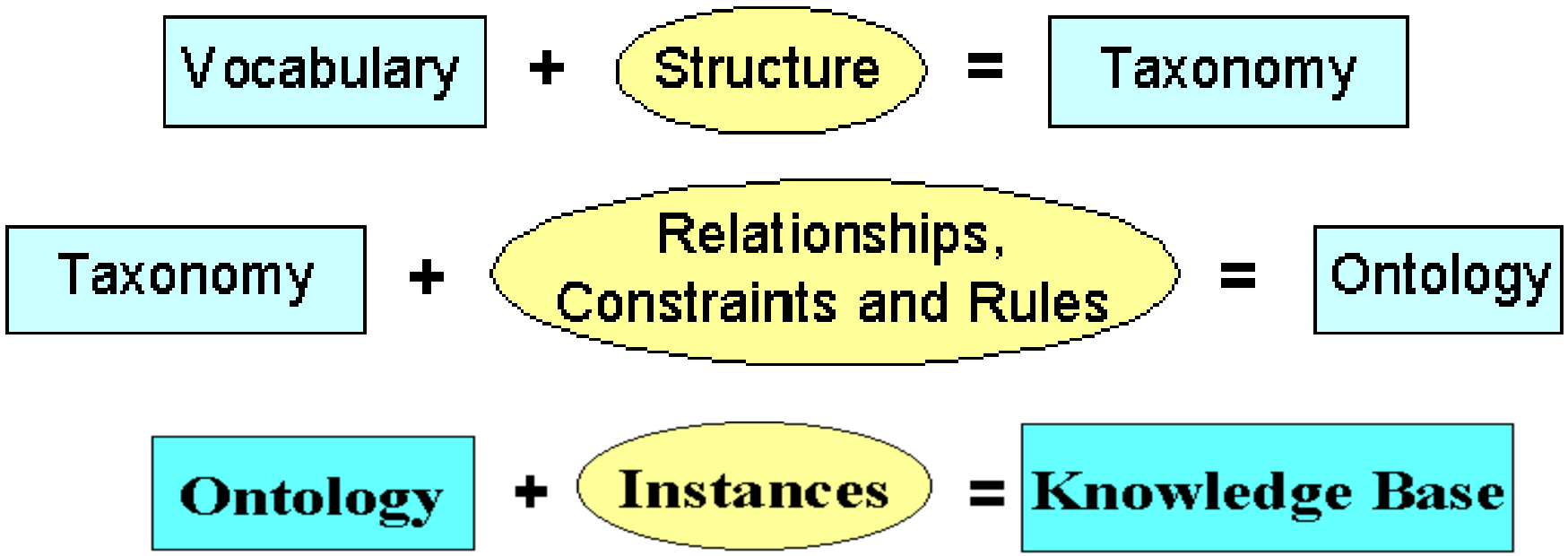


PART II

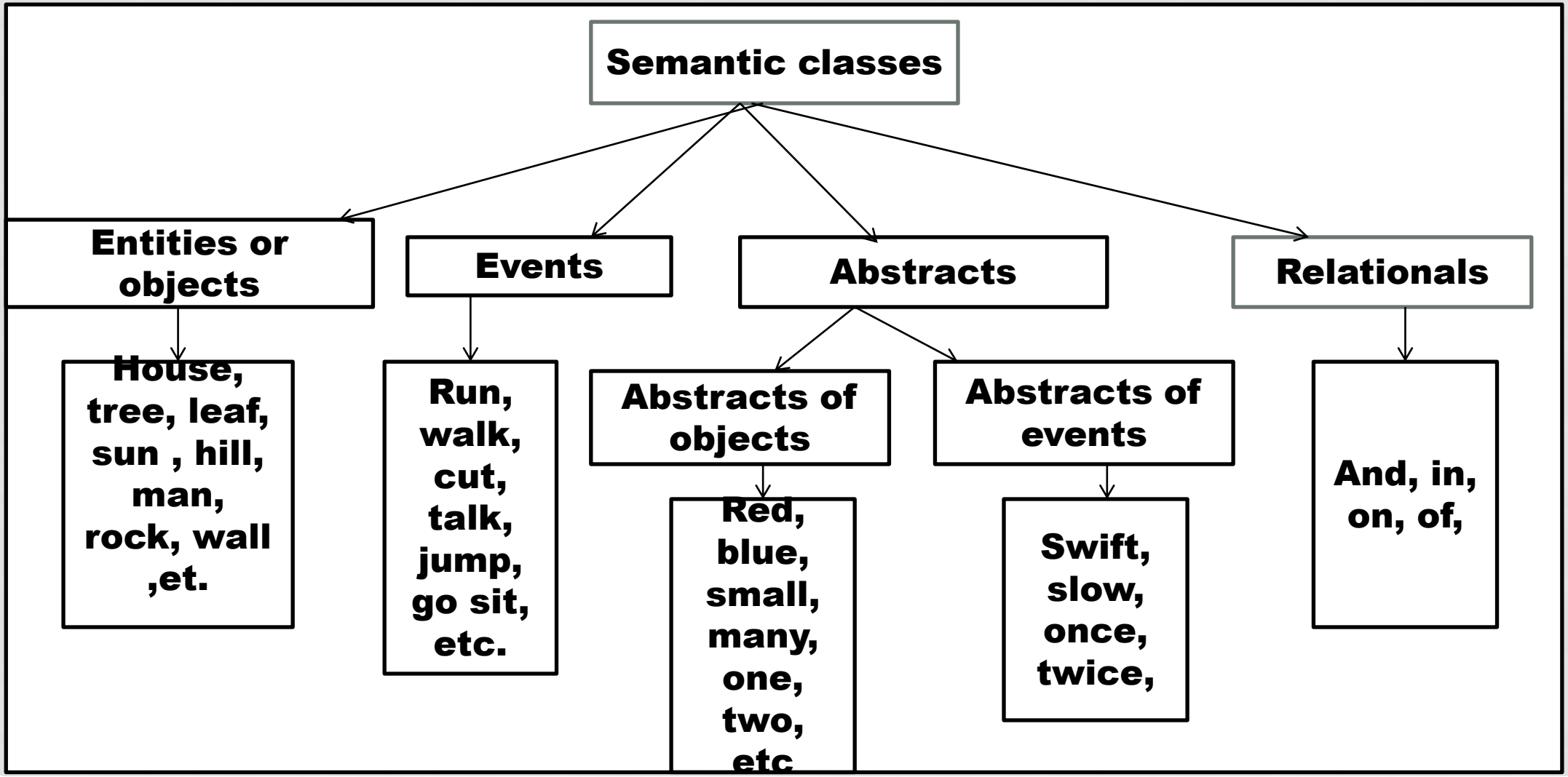
VISUAL ONTO-THESAURUS

ONTOLOGY PRINCIPLE

- **Ontology is based on the principle that the lexical items in a semantic domain have shared features which help us to link them by means of lexical semantic features.**



NIDA'S CLASSIFICATION



STRUCTURING OF VOCABULARY

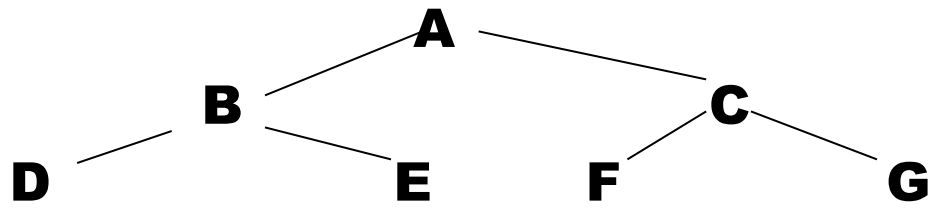
- Vocabulary allows two types of structuring:
  - Branching hierarchy
    - Taxonomic hierarchy
    - Meronymic structure
  - Non-branching hierarchy
    - Linear structure
    - Proportional series or Grids

Branching hierarchy

- **A hierarchy can be characterized in terms of two relations:**
  - **Relation of dominance**
  - **Relation of differentiation**

    The relation that holds between A and B, A and C, B and D and B and E, C and F and C and G is relation of dominance.

    The relation that holds between B and C, D and E and F and G is relation of difference.

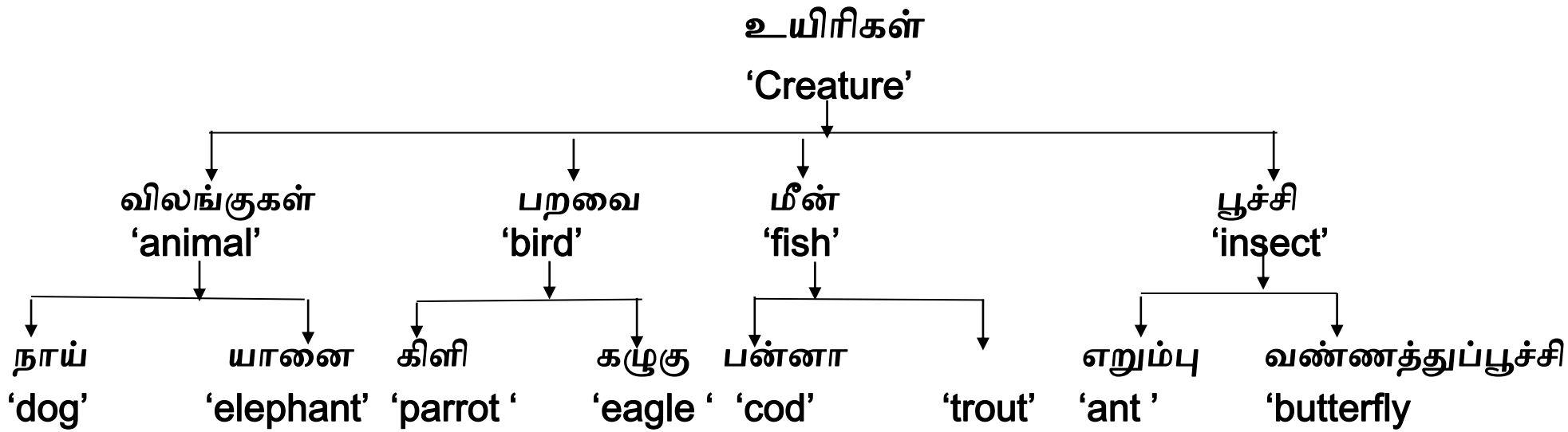


TAXONOMIC HIERARCHIES

- **Taxonomic hierarchies are essentially classificatory system, and they reflect the way speakers of a language categorize the world experience.**
- **A well formed taxonomy offers an orderly and efficient set of categories at different levels of specificity.**

Taxonomies

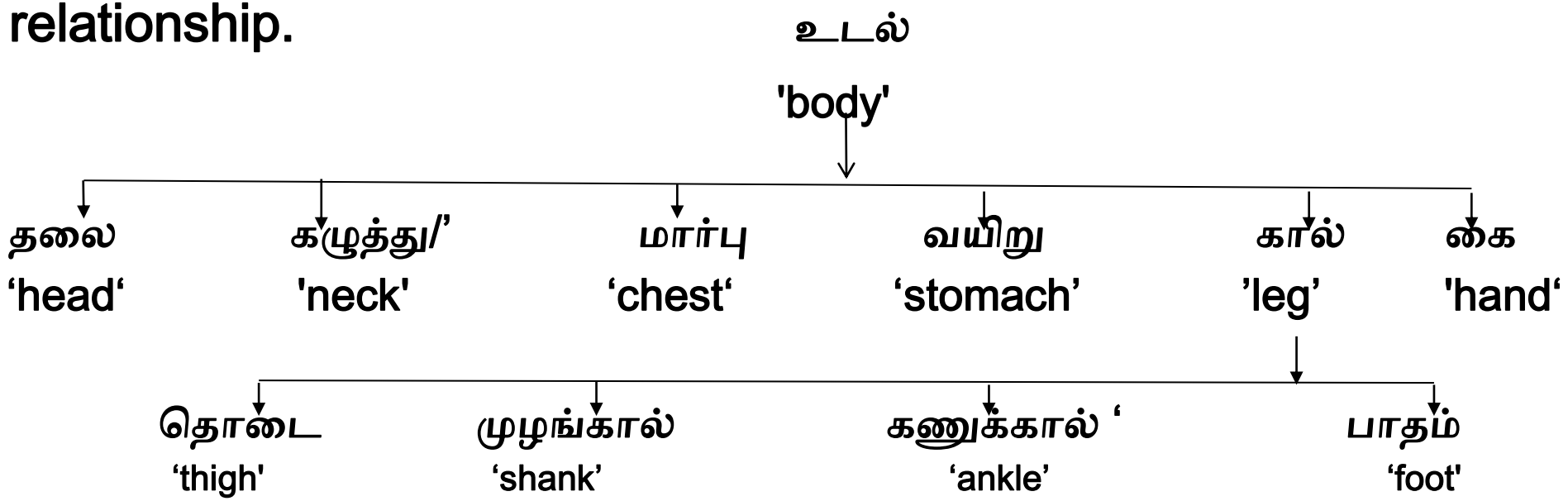
Hyponymy and incompatiblity



There is no inherent connections between hyponymy and incompatibility.

Meronymic Relationships

- Meronymic or partonomic relations are ontological relations that are considered as fundamental as the ubiquitous, taxonomic subsumtions relationship.



NON-BRANCHING HIERARCHIES

Linear structure:

Bipoles vs. monopoles

Bipoles /இருதுருவங்கள்

- **The simplest kind of linear structure is a pair of opposites.**
- **There is perhaps not a great deal to say about these structures, other than what has been said under the heading of opposites.**

NON-BRANCHING HIERARCHIES

MONOPOLAR CHAINS/ ஒருதுருவச் சங்கலிகள்

In **monopolar chains** there is no sense that the terms at the ends of the chain are oriented in opposite directions.

The following are the different types of monopolar chains:

- Degree,
- stages,
- measures,
- ranks and
- sequences

NON-BRANCHING HIERARCHIES

DEGREES / அளபுகள்

Degrees incorporate as part of their meaning different degrees of some continuously scaled property such as size or intensity, but there is no relation of inclusion. The following are the examples:

{தோல்வி, வெற்றி, தனிமதிப்பு}

{fail, pass, distinction}

{பாறை, குன்று, மலை, மாமலை}

{mound, hillock, hill, mountain}

NON-BRANCHING HIERARCHIES

STAGES/நிலைகள்

Stages are points in a lifecycle of something and normally involve the notion of progression. The following are the examples:

{பட்ட முன்படிப்பு, இளநிலைப் பட்டம், முதுநிலை பட்டம், முனைவர் பட்டம்}

{pre degree, graduation, post graduation, master of philosophy, doctor of philosophy}

{குழந்தைப் பருவம், வாலிபப் பருவம், முதிர் பருவம், முதுமைப் பருவம்}

(child hood, youth, middle age, old age}

{முட்டை, லார்வா, பியூபா, வண்ணத்துப்பூச்சி}

{egg, larva, pupa, butterfly}

NON-BRANCHING HIERARCHIES

RANKS /ஸ்தானங்கள்

In ranks, the underlying property does not vary continuously, but in discrete jumps; there is none the less something that a term has more or less of than its neighbours:

{துணைப் பேராசிரியர், இணைப் பேராசிரியர், பேராசிரியர்}

{assistant professor, associate professor, professor}

{ஜமேதார், சுபேதார், தளவாய், தளபதி}

{General, Admiral, Lieutenant, Colonel}

NON-BRANCHING HIERARCHIES

MEASURES /அளவைகள்

Measures are based on a part-whole relationship, with each whole divided into a number identical parts: there is typically a geometrical relationship between values of the scaled property designated by adjacent terms:

{செகண்டு, மினிட், மணி, நாள், வாரம், மாதம், ஆண்டு}

{second, minute, hour, day, week, month, year}

{மில்லிமீட்டர், சென்டிமீட்டர், மீட்டர்}

{millimeter, centimeter, meter}

{இஞ்சு, அடி, கஜம், பர்லாங்கு, மைல்}

{inch, feet, yard, furlong, mile}

{ஆழாக்கு, உழக்கு, பக்கா, மரக்கால்}

{*azaakku*, *uzakku*, paakkaa, marakkaal}

NON-BRANCHING HIERARCHIES

SEQUENCES /வரிசைகள்

Sequences are also ordered terms, but there is no property of 'more or less' with regard to the neighboring terms.

{ஒன்று, இரண்டு, மூன்று, …, }

{one, two, three…}

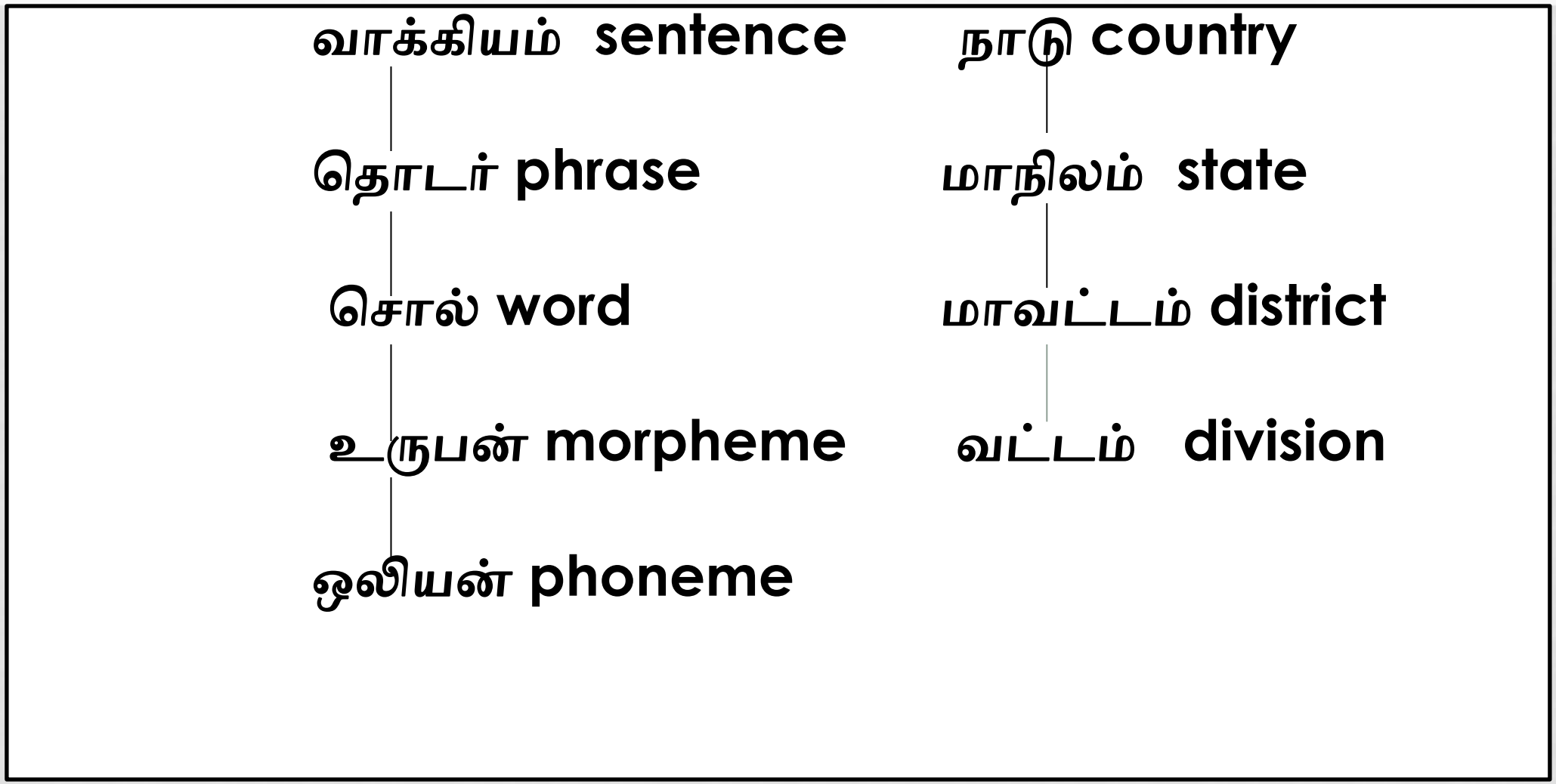
{இறந்தகாலம், நிகழ்காலம், எதிர்காலம்}

{past, present, future}

{கார்காலம், கூதிர்காலம், முன்பனிக்காலம், பின்பனிக்காலம், இளவேனிற்காலம், முதுவேனிற்காலம்}

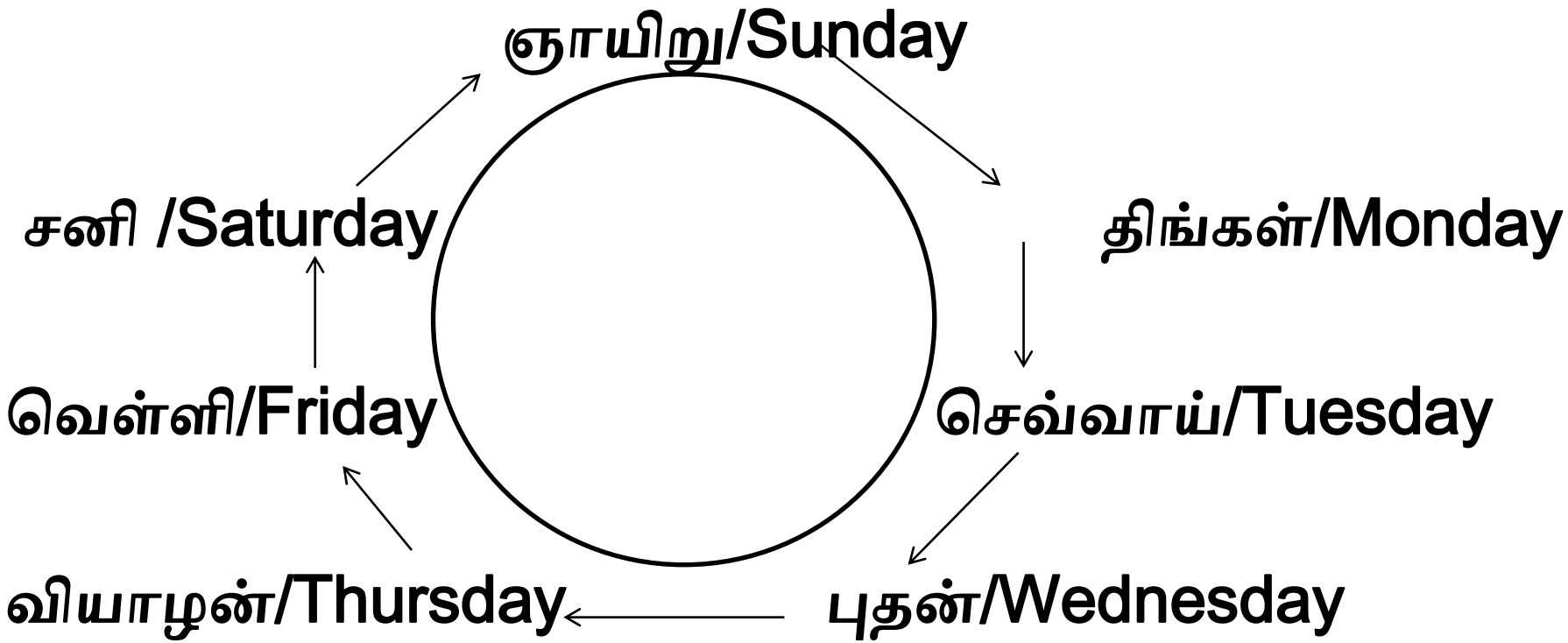
{rainy season, winter season, summer}

NON-BRANCHING HIERARCHIES

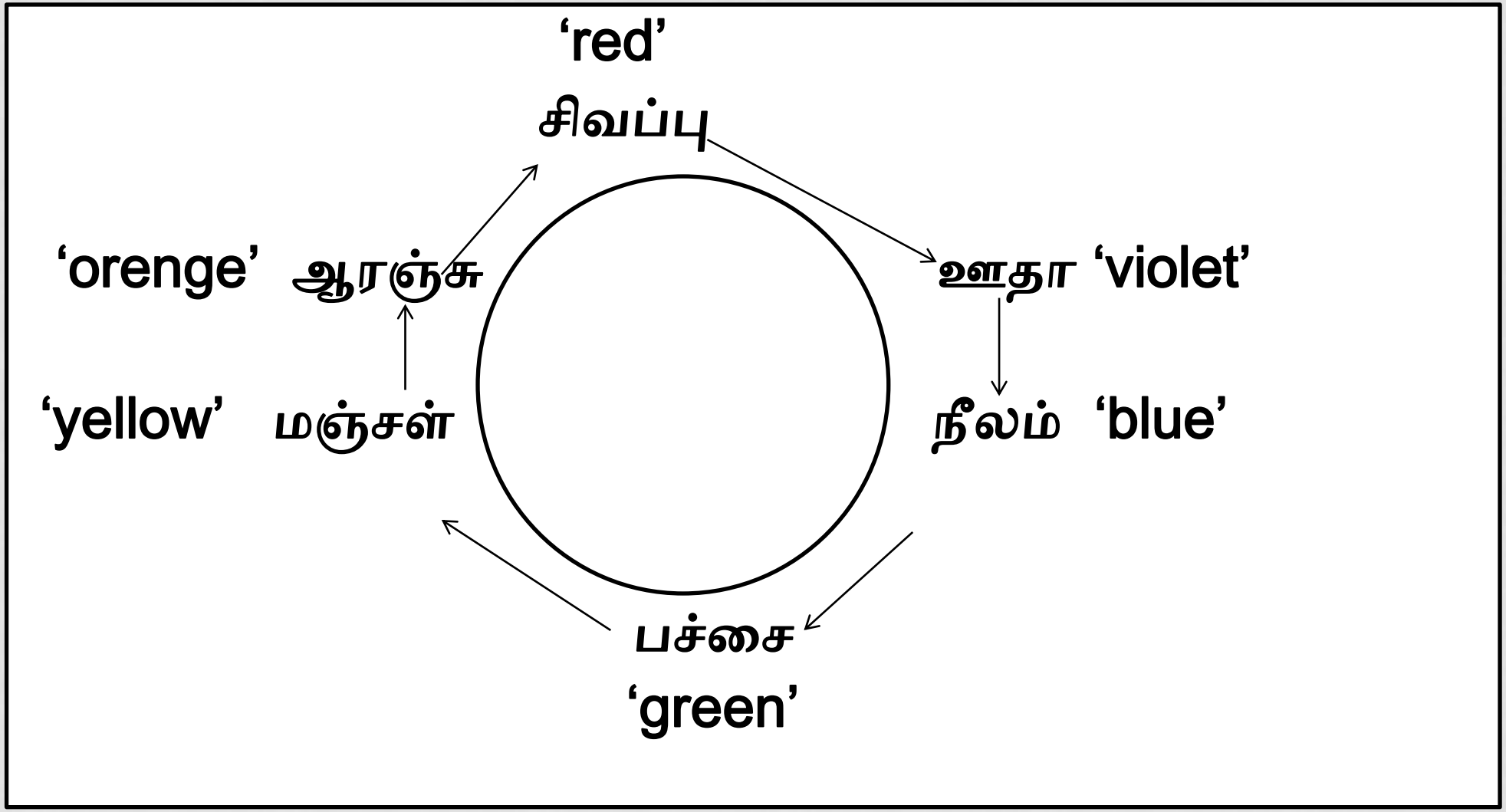


NON-BRANCHING HIERARCHIES

CYCLES/ சுற்றுகள்

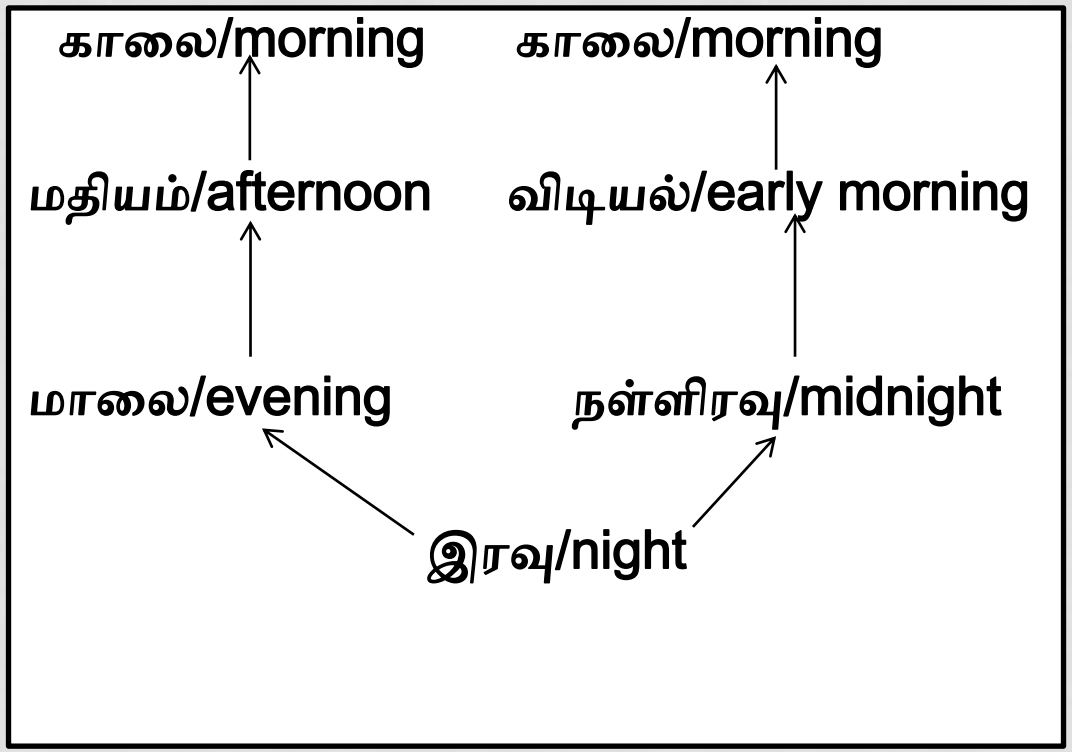


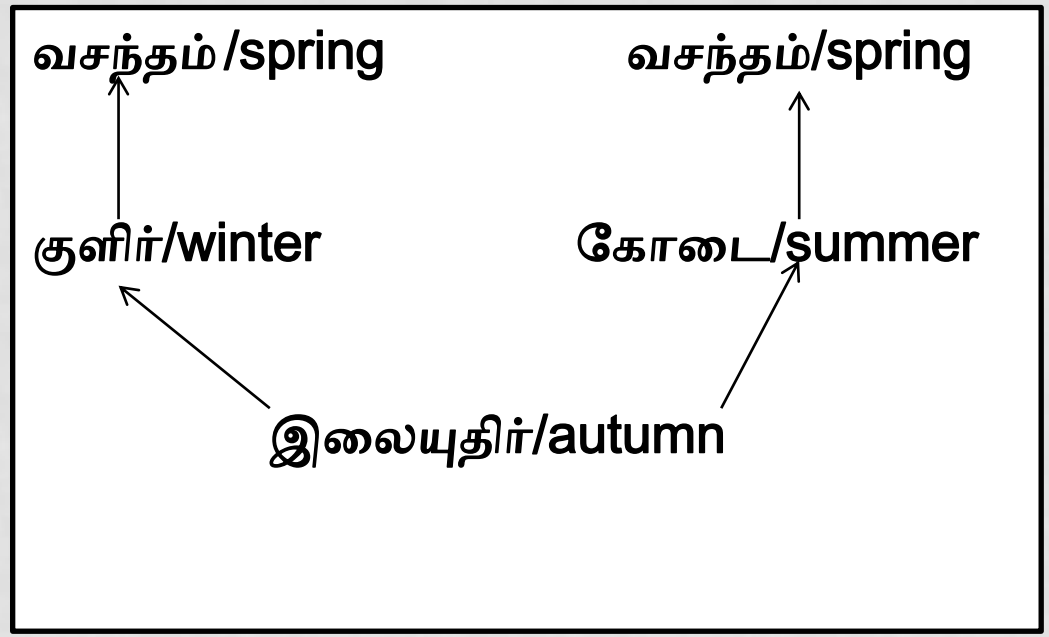
NON-BRANCHING HIERARCHIES



Non-branching hierarchies: HELICES

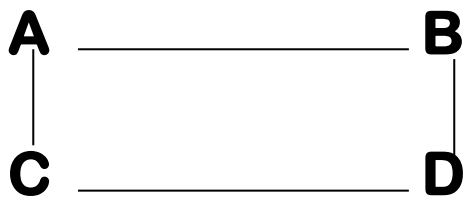
The Combination of linearity and cyclicity may be taken as The defining characteristics of a Helix. The links of a Helical Chain typically refer to periods of time:





PROPORTIONAL SERIES /GRID

The units of a gird is the cell, which consists of four lexical items, any one of which must be uniquely predictable form the remaining three. The followings are the examples of cells



A : B :: C : D **dog: puppy : lion: cub**

யானை: கன்று::பாம்பு : குஞ்சு
elephant : calf :: snake : snakelet
யானை: பிளிறு:: சிங்கம்: கர்ஜி
elephant: trumpet:: lion : growl

CLUSTERS

- Clusters are essentially groups of synonyms.
- There are two main types of clusters:
  - Centered clusters
  - Non-centered clusters

LEXICAL RELATIONS OF NOUNS

Relations	Sub types	Examples
Synonymy		புத்தகம்: நூல் Book : book
Hyponymy-hyperonymy		பசு: விலங்கு Cow : animal
Hyperonymy-hyponymy		விலங்கு: பசு animal: cow
Meronymy-holonymy	Part-whole	சக்கரம்: வண்டி Wheel: cart
Holonymy- Meronymy	Whole-part	மேசை: கால் Table : leg
Meronymy-holonymy	Member Group-	பேராசிரியர் : துறை Professor: department
Holonymy-Meronymy-	group-Member	படை: படைத்தலைவர் Army: captain

LEXICAL RELATIONS OF NOUNS

Relations	Sub types	Examples
Meronymy-holonymy	Place-bigger place	பாலைவனச்சோலை: பாலைவனம் 'oasis :desert'
Meronymy-holonymy	Object-composition of the object	மேசை: மரம் table: wood
binary opposition	Gradable	நல்லவன் : கெட்டவன் good male person : bad male person
"	Non-gradable	ஆண் :பெண் man : woman
"	Privative	உயர்திணை : அஃறிணை rational being : irrational being
"	Polar	ஆடவர் : மகளிர் male person : female person
"	converse pair of social roles	மருத்துவர் : நோயாளி doctor : patient

LEXICAL RELATIONS OF NOUNS

Relations	Sub types	Examples
binary opposition	Converse pair of kinship	தந்தை/தாயார்: மகன்/ மகள் father/ mother : son/daughter
binary opposition	Converse pair of spatial terms	மேலே கீழே above : below
binary opposition	Converse pair of temporal terms	முன்னர் : பின்னர் Before : after
binary opposition	Directional opposites	மேலே : கீழே above : below
binary opposition	Orthogonal opposites	வடக்கு: தெற்கு, மேற்கு; கிழக்கு: தெற்கு வடக்கு north: south, west; east: south, north
binary opposition	Antipodal opposites	வடக்கு : தெற்கு; கிழக்கு: மேற்கு north: south; east : west

LEXICAL RELATIONS OF VERBS

Relation	Description	Example
Synonymy	Replaceable	தூங்கு ‘sleep’: உறங்கு ‘sleep’
Part-whole	Inclusion	பற ‘fly’: பிரயாணி ‘travel’
Entailment	Type - subtype	நட ‘walk : நொண்டு ‘limp’
Entailment	Action - cause of the action	உயர் ‘rise’: உயர்த்து ‘raise’
Entailment	Action – presupposed action	வெல் ‘win’: முயல் ‘try’
Entailment	Part- whole	குறட்டைவிடு ‘snore’: தூங்கு ‘sleep’
Opposition	opposites	கூடு ‘increase’: குறை ‘decrease’
	Converse	வில் ‘sell’: வாங்கு ‘buy’
	Directional opposites	புறப்படு ‘start’: வந்துசேர் ‘reach’

RELATIONS IN ADJECTIVES

Relations	Types	Examples
Opposite (gradable) - contrary	Adjective: adjective	அழகான **‘beautiful’**:குரூரமான **‘ugly’**
Opposite (non-gradable) - Contradictory	Adjective: adjective	உயிருள்ள **‘living’**:செத்த **‘dead’**
Derived form	Adjective: noun	அழகான **‘beautiful’**:அழகு **‘beauty’**
Descriptive	Noun: adjective	வடிவம் **‘shape’**:சின்ன **‘small’**
Relational	Adjective : noun	பொருளாதார **‘economical’**: பொருளாதாரம் **‘economics’**
Similarity	Adjective : adjective	பாரமான **‘heavy’**:கனமான **‘heavy’**

LEXICAL GAPS

- In the design of a Multilingual Lexical Database, one of the biggest problems is constituted by conceptual mismatches between languages, and the resulting matter of lexical gaps.
- Lexical gaps concern words for which there is no direct translation in a target language, but which nonetheless need to receive a translation within the system.

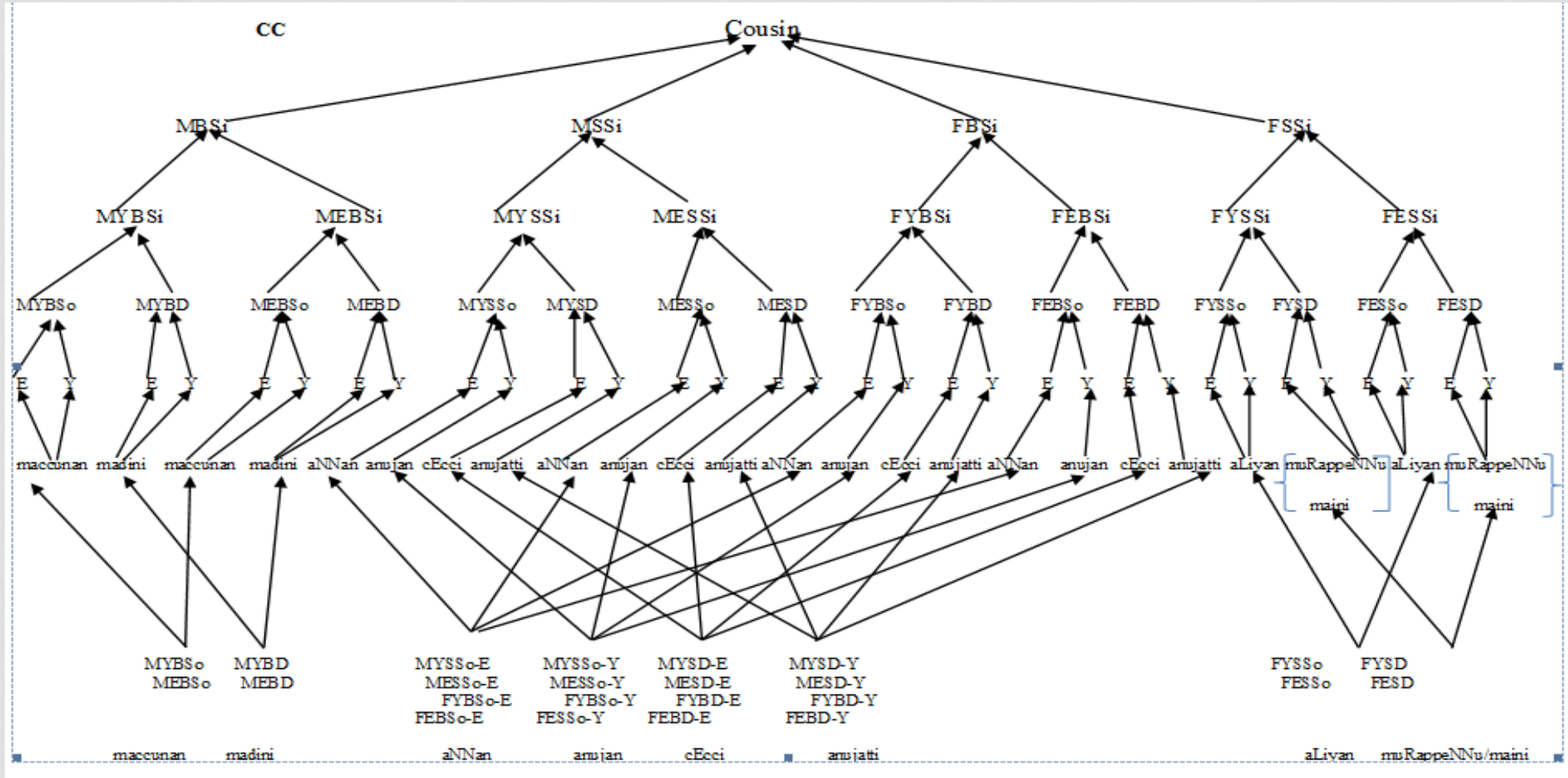
LEXICAL GAPS

- *navakirakam* 'nine planet collection' is an Indic concept.
- It is different from the scientific concept 'planet'
- The world wide WordNet does not accommodate the culturally oriented words found in individual languages including Dravidian languages.
- Lexica gaps can be found in Kinship terms.

LEXICAL GAPS AND UNTRANSLATABILITY

- Lexical gaps in Kinship terms
- Siblings
- Aunts and uncles
- Nephews, nieces and cousins
- Relations by marriage
- Relations by works
- Foreign objects
- Poetry, pun and wordplay, idioms, metonymy, metaphors
- Iconicity

EXAMPLE SHOWING LEXICAL GAPS AND A PROPOSED SOLUTION



DATA BASE CREATION

- A multilingual lexical database is created for Tamil which is extended to Malayalam.
- XML is used for the creation of multilingual lexical database.
- The database takes care of all kinds of lexical and semantic relation between words (only one sense is taken into account in each instance of a word).
- The lexical items of one language will be related to another though lexical IDs.
- The top to bottom approach makes building of the ontological structure of Dravidian vocabulary easier than building WordNet.
- We can achieve the coverage quickly.

LINKING OF ONTOLOGICAL STRUCTURE OF DRAVIDIAN LANGUAGES INTO KUC

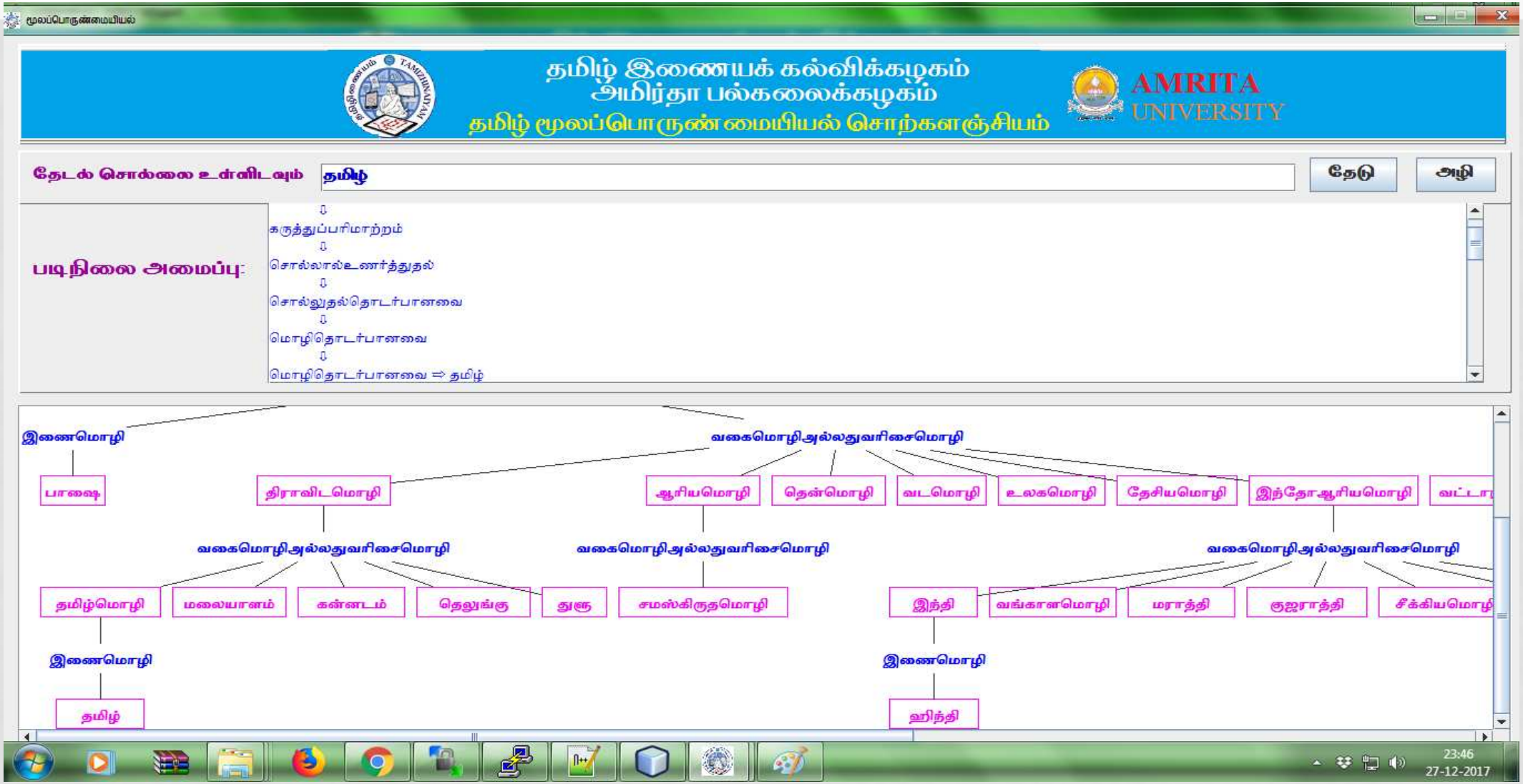
- The key design principle underlying the UKC is to maintain a clear distinction between the language(s) used to describe the world as it is perceived and what is being described, i.e., the world itself, which is independent (up to a point) from the language(s) used to describe it.
- The Concept Core (CC) is the UKC representation of the world and it consists of a semantic network where the nodes are language independent concepts, that we call lexical concepts. Each lexical concept is characterized by a unique identifier which distinguishes it from any other lexical concept.

Fausto Giunchiglia et al

LINKING MULTILINGUAL DATA BASE WITH A CONCEPTUAL LEVEL HIERARCHY

- A conceptual structure will be built for vocabulary taking care of all the languages of the world.
- The multilingual database will be linked with the conceptual structure which is language independent which may be considered similar to UKC.
- There could be conceptual slots in the vocabulary structure of independent languages which will be filled up when the empty concepts are lexicalized i.e. given a word name.
- The ontological vocabulary structure can be easily converted into WordNet by linking the Dravidian lexical items with IndowordNet and Princeton WordNet.

TREE VIEWER


மூலப்பொருண்மையியல்
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அமிர்தா பல்கலைக்கழகம்
தமிழ் மூலப்பொருண்மையியல் சொற்களஞ்சியம்
AMRITA UNIVERSITY
தேடல் சொல்லை உள்ளிடவும்
தமிழ்
தேடு
அழி
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கருத்துப்பரிமாற்றம்
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Ontology Tree Viewer

தமிழ் மூலப்பொருண்மையியல் சொற்களஞ்சியம்
(Tamil Onto-Thesaurus)

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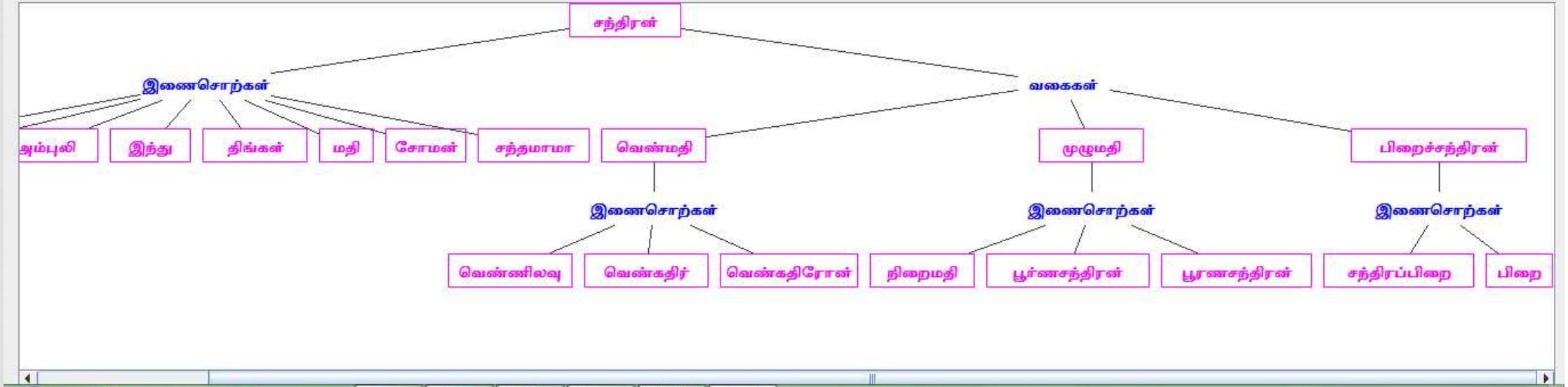
படிநிலை அமைப்பு



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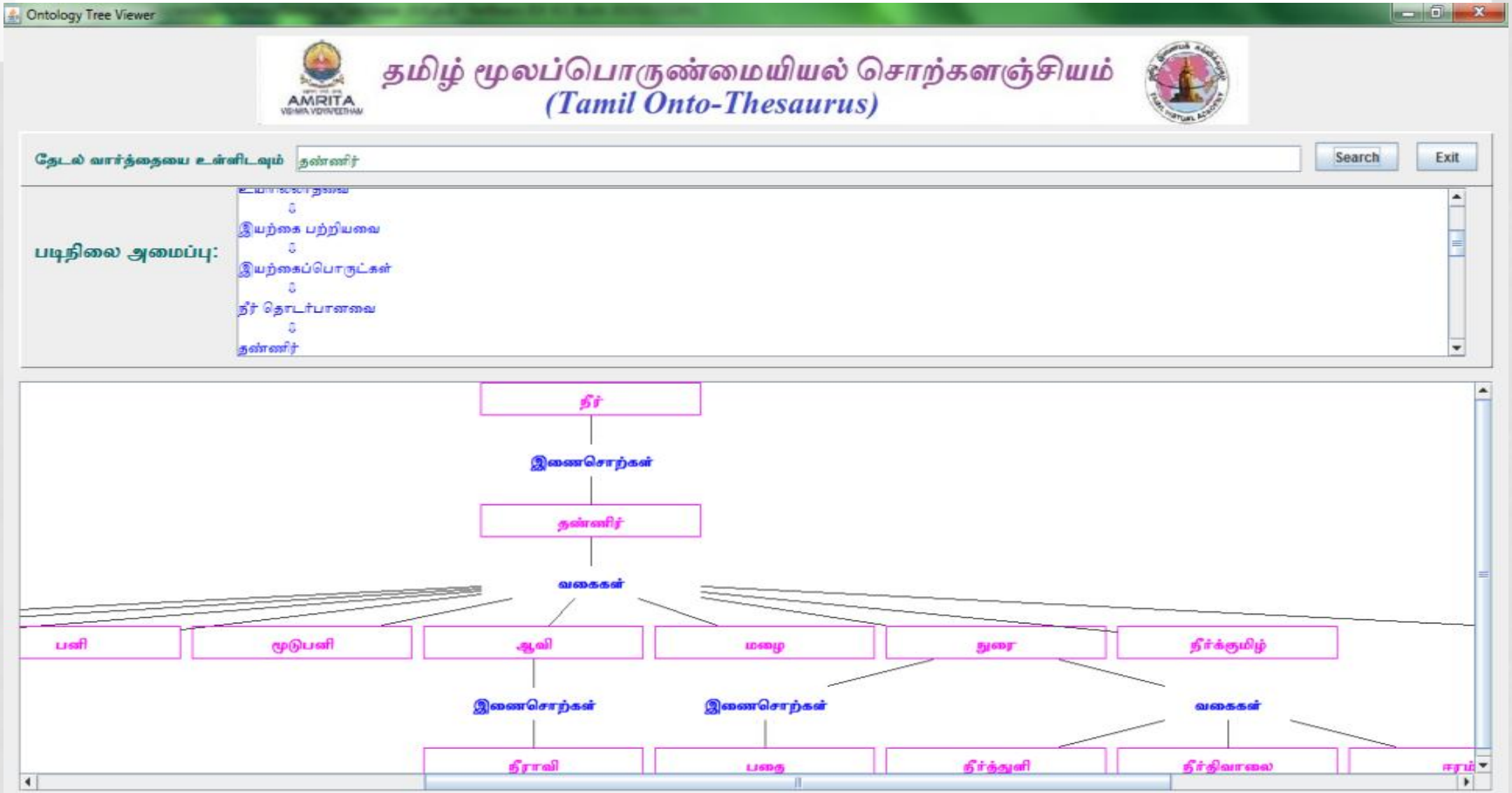
TREE VIEWER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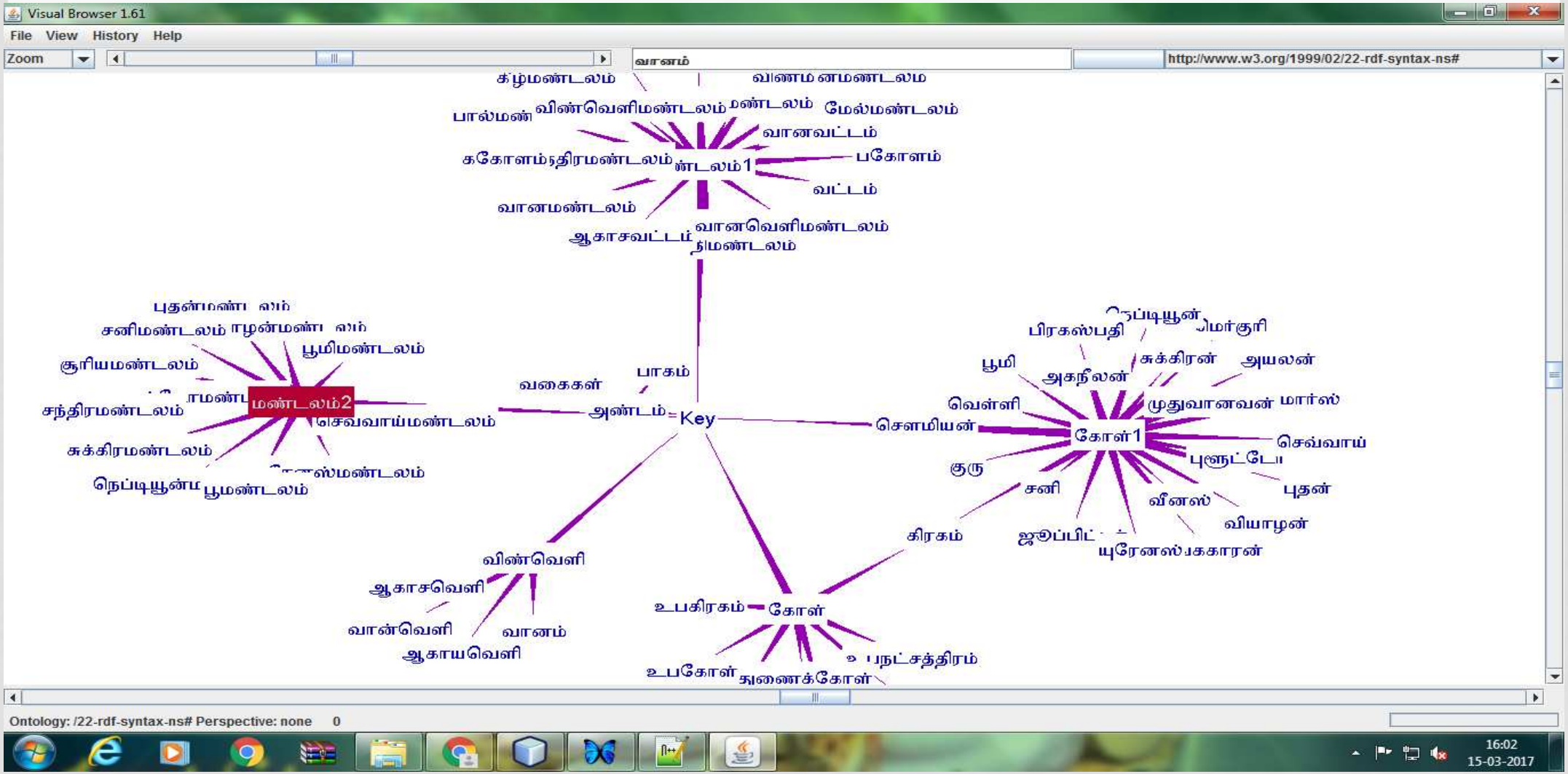
TREE VIEWER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பகோளம்
வட்டம்
வானவட்டம்
மேல்மண்டலம்
வானமண்டலம்
ஆகாசவட்டம்
வானவெளிமண்டலம்
மண்டலம்2
பூமிமண்டலம்
சூரியமண்டலம்
சந்திரமண்டலம்
செவ்வாய்மண்டலம்
சுக்கிரமண்டலம்
பூமண்டலம்
Key
அண்டம்
பாகம்
வகைகள்
சௌமியன்
கோள்1
செவ்வாய்
புதன்
வியாழன்
சுக்கிரன்
அயலன்
முதுவானவன்
மார்ஸ்
பூமி
அகநீலன்
வெள்ளி
குரு
சனி
வீனஸ்
பிரகஸ்பதி
மர்குரி
கிரகம்
விண்வெளி
ஆகாசவெளி
வான்வெளி
வானம்
ஆகாயவெளி
உபகிரகம்
கோள்
உபகோள்
துணைக்கோள்
நட்சத்திரம்
Ontology: /22-rdf-syntax-ns# Perspective: none 0
16:02
15-03-2017

CONCLUSION

- The present data base has to be converted to suit Knowledge graph.
- Knowledge graphs help to incorporate all type of possible relation between words.
- It will be turned into a knowledge representation by linking the lexical items with the Wikipedia.
- The present VOT will be extended to all major Dravidian languages.
- We are now working on VOT for Malayalam

Thanks to the audience and organizers